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THE YELLOW PERIL
By JAMES TRAPIER LOWE

ANGLO-JAPANESE RELATIONS

THE BIRTH OF A NEW WORLD CAPITAL

Vol. XXXII JULY, 1936 No. 7

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The Far Eastern Review

ENGINEERING FINANCE COMMERCE

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The Yellow Peril

(Equality Breeds No War—Plutarch, *Lives : Solon,* Sec. 14)

By JAMES TRAPIER LOWE, Ph.D., Carnegie Fellow in International Law

ANOTHER naval conference has gone by the board, leaving, in all the debris, not one constructive result. A completely unrestricted naval race is in the offing, and the sovereign states of the world are so jittery at the gloomy prospect that modern civilization itself is said to be at the mercy of an " incident."

Japan, as usual, is condemned as the one nation responsible for the impending naval chaos, and, in light of Japan's dramatic departure from the London meeting because of the failure of her diplomats to secure naval equality, this censure seems not without justification. On the other hand, high Japanese authorities insist that of all the interested powers, Japan regrets more deeply than all the rest the failure of the conference. Wherein does the truth lie ?

Japan has come to the crossroads of a great decision, the importance of which can be comprehended only by comparison with a decision Japan made in 1853, when, at the point of a gun, she decided to forsake the static seclusion of the East to embrace the dynamic progress of the West. Since that early judgment Japan has twice staked her all on a fling of the dice. In 1895, she hurled herself against the aged Chinese Giant, and, again, in 1904, against the lumbering Russian bear. Both times, in short, brilliant campaigns she was successful, and to-day she seems, once more, ready to pit herself against the whole world, if necessary, in a bold bid for power in the Far East, this time in the form of a demand for naval equality.

What claims do the Japanese make as to their right to action at this time ? Do the arguments they adduce justify their obvious attempt to create and maintain a navy second to none in the world ? to scrap the 5-5-3 ratio ? to chuck the treaties into the wastebasket?

The 5-5-3 naval ratio was originally established on the premise that England's far-flung empire lay her open to attack in every ocean of the world, therefore she had to have a navy second to none in the world to protect that empire. Secondly, England's defences must be strong enough to protect her small islands against invasion from the continent by a Napoleon in France or a Kaiser in Germany. America, it was argued, had to maintain her forces strong enough to enable her to fight in either the Atlantic or Pacific, therefore her navy must be second to none in the world. But Japan, being only a second-rate power, and having no important colonies or dependencies to protect, need not have a great navy, all that she need defend was a small section of the north Pacific, and even in that area her navy must be kept relatively small enough for it not to be a dangerous menace should England or the United States decide to police that area. Thus, the 5-5-3 naval ratio was imposed on Japan in 1921-22.

England, it is true, needs a navy second to none in the world. She not only has to protect and police her thirteen and one-half million miles of conquered territory ; but also, almost six billion dollars of foreign commerce, which is considered to be the very life blood of the English nation, requires the ultimate in preservation, and England has to be prepared to defend her shores against invasion from the continent. Japan understands that, and has no objection to Britain's claim for naval equality. So far so good.

The Japanese Outlook

Looking at the Americans, Japan sees them possessed of practically a self-sufficient country, unbelievably rich in natural resources, vast in territorial area, immense in population. That we should need a navy second to none in the world is more difficult for the Japanese to understand. We can, if we will, be almost a totalitarian, or autarchial nation ; all our immediate neighbors are either so small physically, or so impotent militarily, that we could challenge the world, at the turn of the twentieth century, with the ringing declaration :— **" To-day the United States is practically sovereign on this continent."** Thus, from the standpoint of essential colonies to protect, or native shores to guard against hostile invasion, we seem to be in almost a unique position, and the Japanese cannot understand why we should have to maintain such a sizeable navy. We have some four and one-half billion dollars of foreign commerce to safeguard, it is true, but that seems hardly enough, relatively speaking, for us to feel compelled to build and maintain a navy as large as the British, who have to police the entire world, or the Japanese, who not only have to protect more than a billion dollars in foreign commerce, but who (strangely disquieting thought) must also conquer and maintain new colonies and dependencies if Japan is to survive as a first class power.

Look, for a moment, at Japan itself. It is a barren, mountainous country, already densely populated, practically devoid of natural resources, and peopled by a race strongly determined that their inequality by nature shall be overcome in precisely the same way that the British have offset the disadvantages nature heaped upon them, by helping themselves to other people's territory. This was not done, in case of the British, to relieve an over-populated Britain. It was done, as it will be done by the Japanese, to meet the increasing demands of industrialization. Japan needs to acquire colonies, dependencies, and spheres of influence, to furnish guaranteed sources for essential raw materials, possible markets for finished goods, safe investment of surplus capital, and lastly and least important, to serve as an outlet for the surplus-population alarmists.

The surplus-population argument or justification for imperialism does not figure prominently in the minds of intelligent Japanese because Japan, contrary to popular opinion, is not over-populated. Japan is densely populated, but, in this age of industrialization, that is possible, without any serious consequences, provided that a nation's markets and sources of supply are open and guaranteed. None of the major empires in the world even approach Japan in density of population, considering their relative positions as empires. The density of population for the British empire is 38.1 ; for the American, 36.9 ; and for the Japanese, 179.4. These, as the Japanese know, are the figures that count because they show, as no others possibly can, the true weakness of Japan's position in international affairs. They also show the absolute necessity for Japanese expansion if Japan is to survive as a first class power.

Japan's Naval Position

Japan's need for a large navy is actually greater than the British because she not only has to protect what she has already acquired, as do the British, but Japan is faced with this even greater problem, she must go on acquiring new colonial territory. She must do the latter for the same reason that the British and Americans hang on so tenaciously to what they have already conquered. And if this be not true, high Japanese officials insist, that is, if colonies and dependencies be not essential parts of the economic or political dressings of a large power, why do Britons and Americans waste billions of dollars every year maintaining navies to protect them ? Or, if that be not the American argument to justify so large a navy, what is it ? America must keep the sea lanes open for her commerce ? America must protect her shores against invasion ? Good. So do we. Moreover, our foreign commerce, while not as large as yours, the Japanese answer us, is vastly more important to us as a nation because of our dearth of natural resources and a large domestic market. And, they continue, we Japanese have a constant and increasingly dangerous menace to our national existence in the form of Soviet Russia, red in tooth and claw, that is greater by far than any military menace that your country ever dreamed of having from Canada on the north, or Mexico on the south. Therefore, our actual need for a large navy is much greater than the corresponding need in the United States of America. All that we requested (and have been denied) is the right to build a navy equal to yours.

To some American statesmen the knowledge that Japan is going to construct and maintain one of the most powerful fighting navies in the world, that Japan is going to use this navy whenever and wherever her interests are endangered, that she is going to continue acquiring new colonial territory, is strangely disquieting. Some of us even get panicky. Senator Key Pittman, for example, has been so moved by the prospect that he has campaigned the nation from Las Vegas to Washington shouting from every housetop : War ! War ! We must fight Japan at once. Japan plans conquest of the entire world. We must do something at once. Another, a former Secretary of State, Henry Lewis Stimson, would plunge us into war with Japan immediately. Still a third, a prominent journalist this time, says that all we have to do is build up our navy, and Japan will realize that when we say that we will " enforce peace " that we mean it. So much so, in fact, that we will fight about it. In that respect he seems to agree with the Chairman of our Senate Committee on Foreign Relations, and a former secretary of state they all seem to believe that aggressive war against Japan would contribute importantly to general world peace.

Pacifists and patriots alike in the United States seem to deplore the fact that we were so weak in 1931-32 that our " diplomats " were forced to eat cold turkey in the " dispute " with Japan. The latter group, composed of the super-American patriots, not militarists, fondly point to Theodore Roosevelt and, by his standard, contrast the weak kneed policies of the later administrations, notably that of the previous incumbent, Herbert Hoover. They reflect sadly upon the great American who built the Great White Fleet and sent it on a world tour so that it might be seen everywhere. " Here was proof," they say, " that we could hold the ocean lanes open for our commercial traffic and proof also that our diplomatic opinions could be emphasized by more than sonorous words. We stood ready to enforce to the letter the ' Open Door ' policy on the Asiatic mainland ; to make peace between Russia and Japan by telling them that Manchuria could not belong to either of them ; to reaffirm the Monroe Doctrine in the New World. All of these things, which had as their fundamental purpose free trade in the world market for American goods, were easy because we had a Navy."

Theodore Roosevelt's Reactions

Theodore Roosevelt was a great American, the trouble is that some of his most ardent admirers know so little about him. They are right, however, in that he did reaffirm the Monroe Doctrine. He " took " Panama from Colombia (to use his own intemperate expression) ; he shook the mailed fist at the poor, ignorant natives in Santo Domingo for being thoughtless enough to run into debt ; and he ordered the Kaiser of the strongest military force in the world to get out of Venezuela within forty-eight hours, or fight. He built the Great White Fleet, and sent it around the world that the Japanese " should realize that I am not afraid of them." But at the same time, Mr. Roosevelt was a very hard realist. He believed in the inevitability of war, and, indeed, enjoyed it very much. His personal files show how ardently he had hoped for war with Spain, and how terribly afraid he had been that it might end before he could see action. In the Russo-Japanese war the plans had already been drawn up by his direction to go to the aid of Japan, and Roosevelt was sorely disappointed that he could find no excuse for doing it. " I think the Japanese will whip them handsomely," he had written to Hay on August 29, 1904. Later, he had paid the Japanese the highest compliment that he could, by saying that " Japanese soldiers and sailors have shown themselves equal in combat to any of whom history makes note." Yes. Roosevelt was a militarist, and he stood ready at all times to enforce to the letter respect for American interests wherever and whenever they might be jeopardized. But where Roosevelt was perfectly safe, and where certain of our senior Senators, more than one Secretary of State, and a host of journalists, err sadly, was in his clear understanding of American interests, and where and how they might need protection.

As Americans, some of us seem to be under the delusion that our Open Door policy in China is an integral part of the " life line " of the American empire, that it is part of our " vital interests," that we have to protect the doctrine even unto death. Further, we seem to think that the only power that could, and would, cut the " life line " is Japan, therefore our national interests would be best served by an aggressive war against Japan to maintain the Open Door in China. When England, France or Russia violate the Open Door we acquiesce quietly ; it is apparently only against Japan that we are prepared to defend to the last our huge commercial interests and very lucrative trade with the " teeming millions " of Cathay.

American stake in the Far East, as a matter of dollars and cents, is in Japan, not China. Less than one per cent of all our foreign investment is in China ; there are fewer Americans in all China than in the suburb of any large city in the United States ; our trade with that country runs a considerable annual deficit because we send back to China in charity about five dollars to every one that we take in business. By what system of logic, therefore, are we anxious to defend our " interests " in China ? or Chinese war-lords ? or a bankrupt commercial policy called the Open Door ?

The Factor of Trade

Our trade with Japan is very important to the United States. It is also important to Japan, and it makes a perfectly natural and very valuable economic link between the two countries. We sell cotton to Japan and buy raw silk from her for processing and sale in the United States and abroad. Japan ranks fourth among world markets for American exports, and second (in the world market) as a source of imports into the United States. That is why, I am sure, Theodore Roosevelt counseled friendship with Japan and dignified retreat from China. Roosevelt was even willing to give up the Philippines in his endeavor to preserve the peace with Japan :— " The Philippine Islands form our heel of Achilles . . I think that to have some pretty clear avowal of our intention not to permanently keep them and to give them independence would remove a temptation from Japan's way and would render our task easier." Since the Open Door is only a commercial policy, and one that results in a deficit every year, why fight to maintain it ? Roosevelt understood that perfectly, and, contrary to a general impression in the United States, made it the basis of his Far Eastern policy.

Roosevelt's views specifically about the Open Door in China, and about Manchuria, or how we, as Americans, should react to the continued acquisition of new colonial territory by Japan, are clearly set forth in Roosevelt's own language, and are derived from a number of unquestionable sources, both public and private. Writing a personal letter to President Taft on December 22, 1910, Roosevelt urged Taft to take cognizance of certain important realities in the Far East. Foremost among these realities, Roosevelt pointed out, were the vital interests of Japan and the vital interests of the United States. The latter, he urged, that is our own vital interests, were to keep the Japanese out of America, whereas, he pointed out, the vital interests of Japan were in Asia. "It is therefore," he concluded, "peculiarly our interests not to take any steps as regards Manchuria which will give the Japanese cause to feel, with or without reason, that we are hostile to them, or a menace—in however slight a degree—to their interests." *The Washington Herald*, in contrasting this policy with that of the frantic, anti-Japanese note-writing of Mr. Stimson, said :— "This was wise and statesmanlike advice from a great American to the Government at Washington when Roosevelt gave it. It is much needed advice to the feeble and fatuous Government we have at Washington to-day." Might not the same be said for certain of our senior Senators, Cabinet members, and journalists of to-day ?

"The Open Door"

"The open door policy in China," continued Roosevelt, "was an excellent thing, and I hope it will be a good thing in the future, so far as it can be maintained by general diplomatic agreement ; but,"—and the "but" looms up very largely—"as has been proved by the whole history of Manchuria, alike under Russia and Japan, the open door policy, as a matter of fact,"—and that is the only way it should interest us as Americans "completely disappears as soon as a powerful nation determines to disregard it, and is willing to run the risk of war rather than forego its intention." This doesn't sound very much like Roosevelt was ready to "enforce to the letter the 'Open Door' ; nor does it sound like he was prepared to 'make peace between Russia and Japan by telling them that Manchuria could not belong to either of them.'" It does sound like he felt that the fate of Manchuria was none of our particular business ; it is clear that he felt that no "vital interest" of ours was involved in the fate of Manchuria.

"However friendly," Roosevelt continued, "the superficial relation of Russians and Japan may at any given time become, both nations are accustomed to measure their foreign policy in sections of centuries ; and Japan knows perfectly well that sometime in the future, if a good occasion offers, Russia will wish to a return game of bowls for the prize she lost in their last contest." That is clear enough, let Russia and Japan fight it out ; "our interests in Manchuria"—Roosevelt concluded—"are really unimportant, and not such that the American people would be content to run the slightest risk of collision about them."

It is true that Roosevelt used the "yellow peril" argument on more than one occasion, but always with the same end in view, that of frightening Congress into making larger naval appropriations. He always considered Congress an annoying nuisance, and any argument, "yellow peril" or otherwise, that would serve to speed up action by that body, was valid. But with all his jingoistic tom-tom beating we should not be ensnared into the delusion that Roosevelt was, at heart, anything but strongly pro-American, that is pro-Japanese in the Far East.

The Roosevelt Viewpoint

Some years before Roosevelt wrote his very strong letter to President Taft about the Open Door policy in China, he, as President of the United States, negotiated a formal alliance with Japan. This was done through the medium of an executive agreement, which was concluded by the Secretary of War, Taft, who pledged United States support of the Anglo-Japanese alliance "wherever occasion arose." At that time England was allied with Japan to give her a free hand to deal with Russia ; should France or Germany come to the aid of Russia, England was to use all the forces at her command to support Japan.

Finally, on July 8, 1905, Theodore Roosevelt proposed a Japanese Monroe Doctrine for Asia. This he did in a conversation with Viscount Kentaro Kaneko, who reported it to his government by cipher telegram on July 11, 1905 : "The future policy of Japan towards Asiatic countries should be similar to that of the United States towards their neighbors on the American continent." This policy, in the opinion of Theodore Roosevelt, was that America should exercise an international police force on the American continent. He explained that our adherence to the Monroe Doctrine forced us, on occasion, to use our resources to keep the peace and maintain order in the smaller republics to the south. The military occupation of Santo Domingo because the poor natives had run into debt was a typical example. This was the first point in Roosevelt's program for Japan, that she should maintain and exercise an international police force to keep the peace in Asia.

"If Japan will proclaim such an Asiatic Monroe Doctrine," said the President, "I will support her with all my power, either during my Presidency or after its expiration."

Theodore Roosevelt, as a realist and a keen student of history sincerely believed in Japan's future greatness. He was not a man to close his eyes to the facts of history, nor to ignore the lessons derived therefrom. Roosevelt early saw that our best interests would be served by encouraging Japan, not hindering her. Her track of empire is eastward, ours is westward, they need never conflict. If we recognize Japan's actual need for naval equality, her perfect right (physically, morally and legally), to the construction and maintenance of such a navy, we will give the lie to Hegel's assumption that the *one* great lesson of history is that history teaches us *nothing*, we will know the truism that history is "not a burden on the memory but an illumination of the soul." Japan's vital interests are in Asia, ours in America ; therefore, let us not oppose the Japanese demand for naval equality, let us encourage it by every means in our power ; further, in our own best interests, let us encourage Japanese expansion in Asia by reviving the active co-operation with Japan undertaken by Theodore Roosevelt.

Anglo-Japanese Relations

By BARON KEISHIRO MATSUI

THE relations between Japan and Great Britain have always been cordial, and the Japanese generally have entertained the friendliest feelings towards, and a high regard for, the British people. The two nations have many points in common : in their profound attachment to traditions and ancient institutions ; in their rise from comparatively small island nations to great sea powers ; and in various other respects. These facts went far towards promoting the mutual understanding and goodwill of the two nations, which finally came to form an alliance, stimulated by external circumstances, and united by a community of interest, aims, and ideals.

The Anglo-Japanese Alliance will always be remembered as a masterpiece in the diplomatic history of Japan and England. It is unnecessary here to dwell on its immense contribution towards the maintenance of the peace of East Asia and of the world.

Japan has remained since the opening of the country on the best of terms with the United States of America as well as with Great Britain. But the Anglo-Japanese Alliance and the Russo-Japanese War marked a turning point in Japanese-American relations, which failed to keep step, with the auspicious development of those between Japan and Britain. That was in a sense a high price for Japan to pay. But the Japanese nation was willing to stay as a faithful partner of the alliance at any cost. On the other hand, after the World War opposition to the alliance gained ground in England and especially in the Dominions—an opposition born of a regard for American feelings in addition to other considerations. Thus, the Anglo-Japanese Alliance was dropped in 1922 with the conclusion of the Four Power Treaty at Washington. From then onwards the friendship between Japan and Great Britain began to lose its former warmth. However, it would be rash to attribute to the abandonment of the Anglo-Japanese Alliance alone the unhappy turn that the relations between Japan and Great Britain have taken during the past decade or more. It seems to me that there are more general and ineluctable reasons, which are to be found in the march of mankind or, in other words, in the very law of progress.

I have already enumerated the similarities existing between our two nations. But there are also dissimilarities, which must now be pointed out.

Ours is the "Land of the Rising Sun," whereas on the British Empire—as is proudly declared—the sun never sets. There is a real significance in these symbolic phrases which cannot be ignored. More than three hundred years ago Britons first stepped out into the wide world. The doughty sons of England scoured the seven seas, despoiled their precursors —the Portuguese and Spaniards— of their lands and riches, acquired new territories and, in a brief period and without meeting much resistance, founded an immense empire. To-day Great Britain is a country powerful, rich, and mature. Japan, on the contrary, awoke just eighty years ago, only to find the continents of the world all divided among occidental Powers so that there was no such room or chance for expansion as was at the disposal of the early English empire-builders.

Japan, small in area, poor in natural resources, is harassed by the problem of population. The country to-day, crowded with 80 million people, active, alert and vigorous, is very much like an old skin that cannot hold the new wine. Nevertheless, we cannot acquire new territories as the British acquired them with so little trouble. Across the waters of the Pacific we see vast lands, including Canada, New Zealand and Australia, which await the coming of able, efficient and industrious pioneers, but which are absolutely closed as far as Japanese are concerned. The authorities of these Dominions state that they have no prejudice against the Japanese as a people, but cannot accept Japanese immigrants because of our low standard of living. On the basis of their apparent belief that the culture and civilization of a nation are determined by the level of its standard of living, the British and other advanced nations of the West claim that they are striving to lift the backward peoples to higher living and thus to advance their culture and civilization.

We do not find it necessary to discuss whether the reasons for the anti-Japanese legislation in the British Dominions are racial or economic. Nor do we care to send emigrants to states where the entry of Japanese is not desired. But we are endeavoring to realize a higher standard of living and to promote culture and civilization—an endeavor with which the Western nations should surely have no quarrel. Now, how are we to achieve that end—how acquire wealth when our land is so small and poor, and the door for immigration is closed on all hands ? The only means that is left—as is plain to anyone—is the development of our industry and commerce.

The First Obstacles

By dint of diligence and perseverance we improved the organization and technique of our industry and commerce, and were ready to ship our merchandise abroad. But the very moment we had reached that stage, China, our nearest and most important market, was closed as the result of the political campaign against Japanese goods. Japan was forced to seek markets elsewhere. Then the British merchants and manufacturers raised a hue and cry over the so-called menace of Japanese goods, and conducted agitations in all parts of the globe. Great Britain, the British possessions and colonies such as India, the Straits Settlements, Ceylon, the British Dominions like Canada and South Africa, and other countries under British influence—all proceeded to curb Japanese imports by raising customs duties or by the imposition of exchange compensation duties and quota systems. Japan's protests on the ground that discriminatory treatment such as was meted out to Japanese goods by the quota systems constituted a violation of the most-favored-nation clause of the treaty of commerce between Japan and Great Britain were of no avail.

Although the natives in the British colonies welcome Japanese goods on account of their low price and good quality, the British authorities seem to be only intent upon protecting the interest of a few producers at the expense of the large numbers of consumers. As a matter of fact, the balance of the Japanese-British Empire trade is in favor of the British Empire by 20 per cent, while the total volume of our foreign trade, even at the latest date of its expansion, constitutes only three per cent of the total volume of the world's foreign trade, of which Great Britain does 13 per cent, the United States 12 per cent, Germany nine per cent, and France eight per cent. In the face of these figures it is inconceivable that the competition of Japanese goods can be a menace to the world market, which still holds so much room for exploitation.

England, having furled her banner of free trade, which she had carried for so many years, is now trying to protect her industries by measures of control based on political power. Some critics doubt if England, by such means alone, without effecting the necessary improvements in industrial efficiency and organization, can in the long run obtain the best results, although this is, of course, a matter that must be left solely to the judgment of the English people themselves. At the same time, Japan and other countries are compelled to ponder deeply whether a great country like Britain, with its vast overseas territories, rich natural resources and extensive markets, is justified in closing the doors of those territories for its own selfish interest alone, and whether such a step is conducive to the promotion of world commerce and trade and to the maintenance of universal peace.

Britain possesses territories in all parts of the world, inhabited by all kinds of races. The British, with their adroit method of handling alien peoples, have been successful in their colonial administration, adopting such policy as is best suited to the peculiar circumstances of each one of these territories. Britain has grown in wealth by drawing raw material for her manufacturing industries from her far-flung possessions and by marketing finished articles back to them. We hear frequently of European exploitations of Asiatic and African colonies for European prosperity. Of such exploitations, if they may be so regarded, the British Empire presents an excellent example. However, the Asiatic peoples, including those under British rule, are now-a-days beginning to awaken and assert themselves, though gradually. The hand of the Imperial Government cannot but feel in more than one way the force of this slow but deep-rooted movement. Herein lies, I believe, one of the acutest problems that to-day confront the British Empire. The Government of India Act recently sanctioned by the King may perhaps be taken as a straw showing which way the wind is blowing.

The Road to Conflict

The British Empire, which has everything in the world, naturally wishes to continue enjoyment of what she now possesses. But it is obvious that a policy of maintenance ot the *status quo* is unacceptable to those nations which, under the existing conditions, can neither live nor thrive. The present situation in Europe is an eloquent revelation of this fact. It is inevitable that elsewhere in the world there should also be collisions between the aspirations of the subject races and the pressure for the maintenance of the *status quo* exercised by the Governments which rule and hold them in leash.

It is the law of progress that backward countries should develop at a more rapid pace than the advanced nations in order to catch up, and it is the law of human nature that every people should aspire to rise to the high level set up by others. The peoples of Asia are now moving forward at a very swift rate to overtake the nations ot Europe and America. This awakening of Asia may be traced to the victory of Japan over Russia, one of the greatest of European Powers. For some two hundred and twenty years the Japanese lived the life of a hermit nation under the seclusionist policy of the Tokugawa Shogunate. But with the Restoration of Meiji the country opened its doors to foreign intercourse, bringing into full play the long-pent-up energy of the race. Japan has forged ahead with an amazing speed during the past eighty years. Having consolidated her position after successive foreign wars, she is now admittedly the leader of all Asiatic races, and as a matter of fact is being made to serve as the model for their national reconstruction and development and for their international advancement. Hence the growth and progress of Japan affects Great Britain not only directly, but also indirectly through the reaction they have on the latter's subject peoples in Asia. That is one aspect of Anglo-Japanese relations in the Asiatic field.

Anglo-Japanese relations in East Asia center about Chinese problems. China has long been the object of numerous international treaties and agreements between occidental Powers on territorial integrity, equal opportunity, and the open door, and what not. The Powers have entered into various relationships between themselves, making China not a principal party of their treaties, but an object to which those treaties were applied. Dr. Sun Yat-sen, the founder of the Kuomintang, with which the present Nanking Government is identified, used to preach the so-called "Great Asia Doctrine," advocating a concert of all Asiatic nations—especially of Japan and China. After the death of the leader, the Kuomintang launched upon an anti-foreign campaign with slogans such as "Abrogation of Unequal Treaties," or "Down with Imperialism," although the party was often unscrupulous enough to invoke even those treaties, humiliating as they were to China, if such a step served the purpose of playing off one Power against another.

The history of European penetration of China was begun with the Opium War some ninety years ago by Great Britain which, apart from Russia, has long played the most prominent rôle. Starting with the acquisition of Hongkong, the British leased Weihaiwei and Kaolung, and established concessions in various cities in China, in addition to acquiring suzerainty in Burma, and securing, a special position in Tibet. They also took over the control, direct or indirect, of the Chinese Maritime Customs, the Salt Gabelle and the postal administration. They acquired various railway rights and numerous commercial concessions. In China they came to occupy a position far superior to that of other occidental Powers. Here again British policy aimed principally at the maintenance of the *status quo*.

However, more recently the British were compelled, because of the violence of the Chinese campaign for the recovery of rights, to abandon part of their concessions, and their commercial rights have suffered certain abridgements. Britain's policy since 1927 seems, therefore, to have been to evade the brunt of the Chinese anti-foreign campaign and to rehabilitate her commercial position in China. Friendship was cultivated with Chiang Kai-shek and his group in the south and with Chang Tso-lin and his son in the north, while the British Government supported the Nanking Government. Now it should be borne in mind that the fundamental aim of the Kuomintang lies in the liberation of China according to the doctrine of the "Three Principles and Five Rights." In the last analysis, the party represents the nationalist movement of Asiatic races in general. Deep in the hearts of the Kuomintang leaders there burns the flame of the idea of Great Asia as pronounced by Sun Yat-sen. Can Britain really subscribe to such a doctrine, even indirectly? Is it possible for Great Britain to deal with Chinese, Indian, and all other Asiatic peoples under one consistent policy? I believe there is no small difficulty. On the other hand, the stand of Japan in this regard is entirely different. Any discussion of Anglo-Japanese relations in China must take into full consideration the respective stands of Great Britain and Japan towards China with reference to the general movement of the Asiatic races.

Regarding Manchoukuo

Anglo-Japanese relations require readjustment also in view of the establishment of the independent State of Manchoukuo, which stands to Japan in an inseparable and interdependent relation. When Japan recognized Manchoukuo in order to maintain and preserve peace and stability in East Asia, Great Britain and other occidental Powers in the League of Nations, without adequate comprehension of the situation in this region, opposed the independence of the new state. That the head of the Inquiry Commission dispatched by the League happened to be Lord Lytton was unfortunate for Anglo-Japanese relations. Although many of us do not consider that his views represented British public opinion, the Japanese people in general have been led to believe those views to have been a reflection of British national sentiments. Again, while we appreciate the earnest endeavors of the British delegates at Geneva toward conciliation between Japan and the League of Nations, the fact remains that Great Britain, a most influential member of the League, voted for the adoption of the resolution by the Assembly for non-recognition of Manchoukuo and for legalization of the Chinese boycott of Japanese merchandise—a resolution which did so much to aggravate the situation in our part of the globe.

The existence of Manchoukuo as an independent state is beyond dispute, the new empire having made such splendid progress since its establishment. Great Britain, which had refused recognition to Manchoukuo in accordance with the Lytton Report, soon found it impossible to ignore her relations with the empire. The Barnby Mission was sent, therefore, to investigate the situation. Nevertheless, that mission was of an unofficial character, and its chief errand consisted in the promotion of British economic interests in Manchoukuo. Naturally, it did not carry the necessary weight for counteracting the Lytton Report. The resolution of the League on non-recognition of Manchoukuo still remains in force, obliging Great Britain and other Powers to take an awkward position on questions concerning Manchoukuo.

Take, for instance, the questions of the oil monopoly or extraterritoriality. Great Britain and other Powers claim the privileges of extraterritoriality in Manchoukuo territory as before, and they have protested to Japan against the oil monopoly as an infringement of the principles of the Open Door and Equal Opportunity by invoking the Nine Power Treaty or by citing the Declaration of Independence and the Communication to foreign governments issued by the Government of Manchoukuo in March, 1932. The contentions of the British and other governments are based on the assumption that the Nine Power Treaty is applicable to Manchoukuo, but the obligations of such political agreements as the Nine Power Treaty are not transferable to Manchoukuo without the latter's express declaration of willingness to accept them. The Powers argue that since they have not recognized Manchoukuo, and her territory still constitutes in their eyes a part of China, the Nine Power Treaty is still operative there. The logic may be valid. But in that case the Powers would have to deal with the Chinese Government in all their "Manchurian" questions, which is surely an absurd proposition in the face of present realities.

Again, as to the Declaration of Independence and the Communication of the Manchoukuo Government, cited by the Powers in support of their claims, it should be recalled that the said declaration and communication were ignored by those Powers at the time of their issue, and Manchoukuo as yet remains unrecognized. It is unreasonable that the Powers should try to fall back, now that they find it convenient to do so, on the very documents which they have once deliberately chosen to ignore, and that by citing only certain parts of the documents and discarding totally their principal matter—namely, the independence of Manchoukuo! As Manchoukuo grows in stature and her industries expand, her economic relations with other countries will become still more complex. So long as the British Government continue to disregard the actual conditions in Manchoukuo and fail to arrive at a rational interpretation of the country's status in East Asia, there will inevitably be differences of views between Japan and Great Britain on questions pertaining to that country.

Japan's Major Purpose

Japan as a stabilizing force in East Asia is endeavoring to keep the peace there by all means. It was for the sake of preserving peace in East Asia that we fought China and Russia and participated in the Great War. It was because Japan has played the rôle of watch-dog that peace has been maintained in this part of the world. In fact, the national existence of all Japan and other East Asiatic countries depends upon peace in East Asia. Great Britain and other occidental Powers may have large and important interests in East Asia, but those interests only affect their commercial prosperity, whereas Japan's interests there constitute a question of life or death. There is a fundamental difference between Japanese interests and occidental interests in East Asia. That is why Japan volunteers to shoulder the responsibilities of the maintenance of peace in the region.

Great Britain should first understand fully the position and aims of Japan in East Asia. If Great Britain has a thorough comprehension of these, there can arise no occasion for friction between her and Japan. Japan has no intention to expel or to impair the British interests in East Asia, but she is anxious to adjust the interests of the two countries wherever they may collide.

One of the momentous international problems involving Anglo-Japanese relations is that now pending with regard to naval disarmament. As was clearly set forth during the tripartite preliminary conversations at London last year, Japan stands for equality of naval strength for the three major sea Powers of the world, and for the reduction of that strength to the lowest level possible. The views of the Japanese Government are that each Power should possess only such a navy as is incapable of menacing or attacking another, but sufficient for defending itself, and should try to achieve the real aim of disarmament and lighten the tax burden of the people, and thus contribute to the cause of world peace. The Japanese claim to parity has been recognized in principle by the British Government, but because the latter's proposal for the voluntary declaration of building programs amounts in practice to setting up an actual disparity in naval force, Japan and Great Britain have not yet reached an agreement of views.

Now I imagine that the British Government realize the necessity of relying upon the Japanese navy for the preservation of peace and order in the Pacific east of Singapore. From the naval viewpoint, may it not be said that the Pacific is divided roughly into natural defence areas for the navies of the Powers ? This idea is embodied in the statement attributed to Secretary Swanson to the effect that the American navy should defend the Eastern Pacific and the Japanese the Western, with the 180th meridian as the dividing line. Though the statement was denied later, it very probably reflects American public opinion. Of course, the rôle of the British Navy in the South Pacific is not forgotten in this connection. If Great Britain and the dominion states understand correctly the position and aims of Japan, they will at once realize the rôle allotted to the Japanese Navy in the Pacific, and thus admit the justice and fairness of Japan's naval claims. I am of the opinion that on the naval question between Japan and Great Britain it should not be over-difficult to find a way to a satisfactory solution.

The Urgent Problem

Anglo-Japanese relations are multiform and complex. I regret I cannot for lack of space go further into the tripartite relation among Great Britain, Japan and America, and must leave untouched that phase of Anglo-Japanese relations which concerns the Soviet Union. Let me summarize, however, the one basic argument, which can never be over-emphasized. The most urgent problem for present-day Japan is how and where to direct the nation's overflowing power of growth. As I have said before, we cannot, as the British did in the old days, seek new territories, nor are we allowed to send emigrants to European and American countries or their colonies. The only path for our national growth is in the direction of the continent of Asia, while we have no other means but the expansion of industry and commerce for the enhancement of our economic well-being and prosperity. Great Britain and her Dominions, while refusing Japanese immigration, took at the time of the Manchurian incident an attitude as if they were bent upon interfering with Japan's advance along the only path left to her. And finally they are closing their markets to Japanese trade. Are we to live or perish, flourish or wither away ? We cannot but contemplate with grave concern the enormous obstacles that beset the path of our nation.

Obviously, friendly relations between Japan and Great Britain cannot be promoted by harping on the traditional amity since the days of the Anglo-Japanese Alliance. It is necessary to effect readjustments of the fundamental matters underlying those relations. Will the British try, or not, to shut out Japanese goods from their markets, to prevent the peaceful growth and expansion of Japan, to close the only path for Japanese advance ? And finally, do they recognize the awakening and the evolutionary progress of all Asiatic races ? All these questions must be answered to the satisfaction of the Japanese, dispelling all misgivings. The two countries should first clear away all sources of political friction through mutual understanding of their respective stands in East Asia, and then seek the elimination of the economic friction which is produced by artificial trade barriers. When the political and economic friction is removed, Anglo-Japanese relations will be put once for all upon a sound and enduring basis.

Sir Samuel Hoare said at the banquet of the Japan Society of London on June 19 this year: "Though there may be many difficulties between Great Britain and Japan, the peoples of the two countries should discuss them frankly and freely as friends who are anxious that each should understand the other's point of view, and that a proper understanding and collaboration between Great Britain and Japan are essential to the stability and prosperity not only of Asia, but of the world." Indeed, it is so. The need for Anglo-Japanese understanding and co-operation along all lines, including the problems of East Asia, of naval limitation, of trade and commerce, has never been so great as now.

The Story of Japanese Shipbuilding

At a time when the shipbuilding industry in Britain still has an appalling proportion of its skilled workmen unemployed, when it is relying very largely upon naval orders in the United States and upon "frozen credits" in Germany, it is striking to note writes Franck C. Bowen in the *Liverpool Journal of Commerce* that all the principal Japanese shipyards are working to capacity, and that several of them have actually had to turn away orders. A considerable expansion is foretold in the near future, which makes the foreign shipbuilders take a wider view of things on account of the way other businesses have had to fight for their existence when their particular interests have attracted the attention of the Japanese.

The story of the shipbuilding industry in Japan is one of the most interesting in the history of the sea. Previous to the year A.D. 1000, the Mikado, with a far sight which might have been copied at a later date, issued an Imperial edict that "Ships are necessary to Japan," and ordered every province to build and maintain a specified number of ships for war and commerce in proportion to its size and resources. The invasion of Kublai Khan from the mainland of Asia in the latter part of the 13th Century, when his Armada of 900 ships were repulsed by the Japanese, awakened the general public to the importance of the sea, although it is to be feared that piracy attracted more than commerce.

All these ships were small, but the Japanese of the early 17th Century, just as they are to-day, were anxious to examine every Western idea, and when the famous William Adams was shipwrecked in Japan, and showed that he had not the least intention of interfering in their politics or converting their people to Christianity, he found willing pupils, and having proved his skill as a shipwright he built vessels of over 120 tons on European lines, although it would seem that the Shogun took very good care that none of these ships should pass into any hands but his own. At that time there is every evidence that the native shipyards were in a very big way of business, although they were normally only concerned with vessels of the junk type.

About 1640 an Imperial edict, in accordance with the policy of absolute isolation, strictly forbade the construction of any Japanese ships of over 75-ft. in length or 150 tons burthen. At the same time every sizable junk had to be built with an open stern so that she was not seaworthy enough to make any ocean voyage, even to the neighboring mainland of Asia, and so Japanese shipbuilding was confined to fishing boats and coastal craft for two centuries.

Opening of the Modern Era

In 1853 the American squadron, under Perry, visited Japan and forced them to open their country to trade. The Chinese would have put up a strong resistance, but the Japanese, among the bravest and most warlike peoples in the world, were shrewd enough to see that their weapons and ships could not stand against the Westerners, and immediately repealed the law which stopped natives building ships staunch enough to go overseas. Two sailing vessels were built in Japan in the following year; one was a failure, but the other, constructed under the direction of a shipwrecked Russian crew, made a great impression, and was sufficiently seaworthy to take them away to safety. The Shogun immediately ordered the shipwrights to build six schooners on similar lines, while the various daimios, or local princes, followed his example. In 1859 the Government Dockyard as Nagasaki was opened, and a number of Dutch shipbuilders were brought in to teach the Japanese their methods, finding them exceedingly apt pupils.

Immediately afterwards shipyards were opened at Yokohama and Yokosuka, and shops for the construction of marine engines at Ishikawajima, all of them under foreign management. In 1862 a warship of sorts, the Chiyogadata, was launched at Nagasaki, and in 1865 the first Japanese-built man-of-war which could compare with the vessels of other nations. She was only a 357 ton screw gunboat, the Moisshin, and all the material for her construction had to be imported, but the Japanese were intensely proud of her, and her construction was no mean achievement considering their facilities.

In the 'seventies and 'eighties, the shipbuilding industry improved steadily, turning out a large number of steamers as well as junks, although their tonnage was generally small, and most of them were intended for the coasting and inter-island trade. In the 'eighties, the Osaka Ironworks were founded by Mr. E. H. Hunter, an Englishman, and immediately made a great reputation for themselves. They turned out the first steel ships built in Japan and the first triple-expansion engines. At about the same time the Mitsubishi Company, which was as powerful in Japanese commerce then as it is to-day, took over the Nagasaki Dockyard from the Government, and immediately installed new plant which permitted it to build far better ships, both naval and mercantile. The Ishikaiwajima Engineering Works also passed into private ownership, and the Government, bent on developing as rapidly as possible, began a series of measures for the improvement of shipping.

In 1885 it passed a law forbidding the construction of junks of more than a certain tonnage in order to encourage steamers, and, at the same time, bought a number of foreign ships for transport purposes which it handed over to the shipping business at the first opportunity. The Kawasaki Dockyard was established with the blessing of the Government in 1886, and for the next ten years progress was steady but slow.

Historical Details

After the war with China of 1894-95, the authorities saw that the struggling shipbuilding industry was likely to be hard hit by the large number of foreign ships which had been bought for that campaign, and which were being passed into private ownership, glutting the market. It is true that the biggest ship built in the country, at the Mitsubishi Yard at Nagasaki, was only 1,560 tons, but the possibility was there, and accordingly two laws were passed. One established subsidies for shipping services, including that of the Nippon Yusen Kaisha to Europe, while the other was called the Shipbuilding Encouragement Law, and gave a generous subsidy for steel ships built in the country. Until then only two vessels had been built of that material, the biggest, the 1,500-tonner already mentioned, but with this backing there was an immediate jump, and two ships of 6,000 tons apiece were built in Japan for the Nippon Yusen Kaisha, to run alongside the ten built in Europe. And, considering the circumstances, they were remarkably efficient vessels, although, admittedly, they took a long time to build.

The first three years of the Shipbuilding Encouragement Law showed the possibility of the trade, and the navigation subsidy was accordingly modified to give some handicap to ships built abroad, immediately increasing the output of the home yards. Then came a period of steady expansion, followed by the Russo-Japanese War, which again demanded the acquisition of a number of foreign-built ships for transport and naval auxiliary purposes. But prices boomed, and the shipyards had as much as they could do to satisfy the demands for new ships and to carry out the heavy repairs necessary.

In the fleet which defeated Russia, the biggest Japanese-built vessels were small cruisers; all the important units came from Britain, France, Germany or the United States. But Japan was determined to be self-contained, and even before the war plans had been made to build the largest types. In one jump, the potentialities of the native yards went from small cruisers to 15,000-tonners of the Tsukuba and Ibuki classes, and soon afterwards to the battleship Satsuma of over 19,000 tons. Most of the machinery had to come from abroad and a large proportion of the material, but the Japanese had proved themselves able to build big ships, and very good ones too.

Further Betterments

These naval orders meant a lot to the industry, which also took advantage of the tail-end of the war boom; before that was really over, in 1909, the Government revised the shipbuilding bounties to obtain a better type of steel vessel. The Ministry of Communications had to pass the plans, and although the subsidy could be drawn on hulls only, there was a generous bounty in addition for every horse-power of marine machinery built in Japan.

To begin with, it was feared that this measure would not have the desired result, but in a very short time it was doing almost as much as had been expected of it; it is true that the number of second-hand ships bought by the Merchant Service increased, but the number of new vessels built in Japan increased very much more rapidly. The majority of them were of modest design, but some very striking liners and fast packets stand to the credit of the yards during that period.

But the expansion was not as great as the authorities had hoped: it was the war boom which made the difference. Not only did Japanese shipping, operating practically as a neutral, make enormous profits and demand a colossal number of ships for service, but the smaller Powers, with no shipbuilding facilities of their own, went to Japan for a good deal of tonnage. In 1917 it was decided that such huge profits were being made by the shipbuilding industry that there was no further need for the construction bounty, but, at the same time, a law was passed which gave generous encouragement for the production of shipbuilding steel and other materials which had, until then, nearly all been imported. By the last year of the war there were 57 active shipyards in Japan, employing roughly 100,000 men, and their products were of a standard which persuaded the U.S. Shipping Board to go to them for 45 standardized steel ships of 374,000 tons deadweight, partially paid for by 250,000 tons of shipbuilding steel of which the Japanese were short.

The post-war slump, and the checking of the rapid growth of the Japanese Navy by the Washington Treaty, hit the industry very hard, and, frankly, it was quite glad to see a large number of the inferior yards go under. But the Government was very careful to keep the more efficient establishments at work, and the subsidized shipping services loyally backed their efforts by ordering new tonnage of a steadily improving standard. The whole shipping and shipbuilding industry developed a great enthusiasm for the Diesel engine, at first building principally under foreign patents, and of recent years the great majority of the ships built have been so equipped. They are excellent vessels, for the State is willing to help generously provided the standard is high enough, and it is this policy that has not only kept a number of Japanese yards in a very efficient state, but which has produced for the Japanese Merchant Service, always ready to act as auxiliaries to the Navy, some of the finest fast cargo liners, and what are by far the fastest tankers in the world. And at the present time the yards have so many ships on order or in progress that considerable expansion is under consideration, partly with the admitted intention of competing with the European yards for orders from abroad.

All Yards Busy

Five cargo vessels were launched within a fortnight in Japan recently. They were the *Osaka Maru*, of 1,470 tons gross, building by the Kasado Dock Company for the Kobe Sanbashi K. Kaisha; the motorship *Funagawa Maru No. 2*, of 1,000 tons gross, building by the Mitsubishi Jokogyo K.K., Yokohama, for the Nakagawa Kisen K.K.; the *Hokuyo Maru*, of 4,200 tons gross, building by Uraga Dock Company, Limited, for the Kita Nippon K. K. Kaisha; the *Saipan Maru*, 5,400 tons gross, building by the Mitsubishi Zosen Kaisha, Nagasaki, for the Nippon Yusen Kaisha; and the *Canberra Maru*, of 6,300 tons, building by the Mitsui Bussan Kaisha, Tama, for the Osaka Shosen Kaisha.

All the leading Japanese yards are fully occupied with naval and merchant contracts, some of them actually having to refuse orders.

The following are among the merchant ships now under construction, and expected to be completed in 1936: Mitsui shipyards: one 8,000 ton turbine steamer for the Kyoritsu Kisen Kaisha, one 7,500 ton cargo motorship for the O.S.K., and one 6,500 ton steamer for the Kuribayashi Shosen Kabushiki Kaisha. Mitsubishi shipyards: one 8,750 ton turbine steamer for the Kinkai Yusen Kabushiki Kaisha, one 6,500 ton and two 10,000 ton turbine steamers

(*Continued on page 309*)

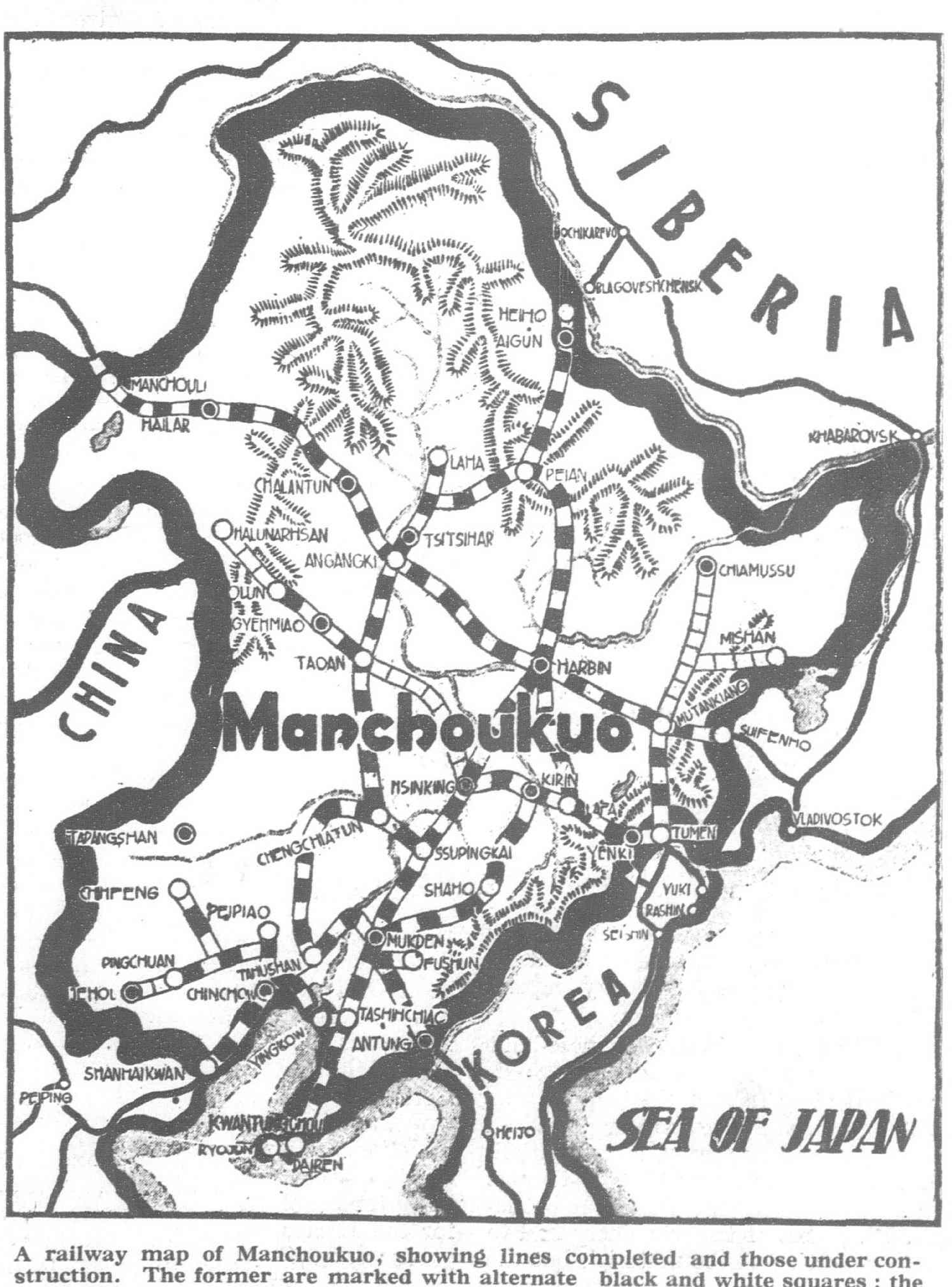
The Birth of a New World Capital

Hsinking, Seat of Government of Manchoukuo, Rises as a Modern Metropolis on the Plain of Central Manchuria

A FIVE year plan involving the expenditure of 30,000,000 Manchoukuo yen to furnish Hsinking, Capital of Manchoukuo, with the primary essentials of a modern city, such as paved highways, sewage system, waterworks, parks, athletic stadium, etc., is well under way, the construction work having commenced in the spring of 1933, as soon as the winter season was over. The present plan, however, is but the first step toward building up an entirely new city adjoining the old town, in such an ambitious scope as to make the city worthy of being the capital of the thriving new State. When the present five year plan and projects are completed, the capital of Manchoukuo will hold a population of 500,000 which is expected to swell further, the maximum estimate being 1,000,000.

Hsinking was formerly called Changchun, noted as the northern terminus of the South Manchuria Railway, and the starting point of the Northern Manchuria Railway, formerly called the Chinese Eastern Railway. Another important railway branches eastwards to Kirin, thence to Tumen where it connects with the Japanese railway system in northeastern Chosen with outlets to good natural harbors on the Japan Sea.

When Manchoukuo declared its independence, it was a big problem where to locate the capital. Mukden and Harbin for a time received favorable consideration but Changchun was selected for geographical strategic and historical reasons and renamed Hsinking, meaning New Capital.



A railway map of Manchoukuo, showing lines completed and those under construction. The former are marked with alternate black and white squares ; the latter with all white squares. The section from Hsinking to Hulanarshan, shown on the map as under construction, is fully completed

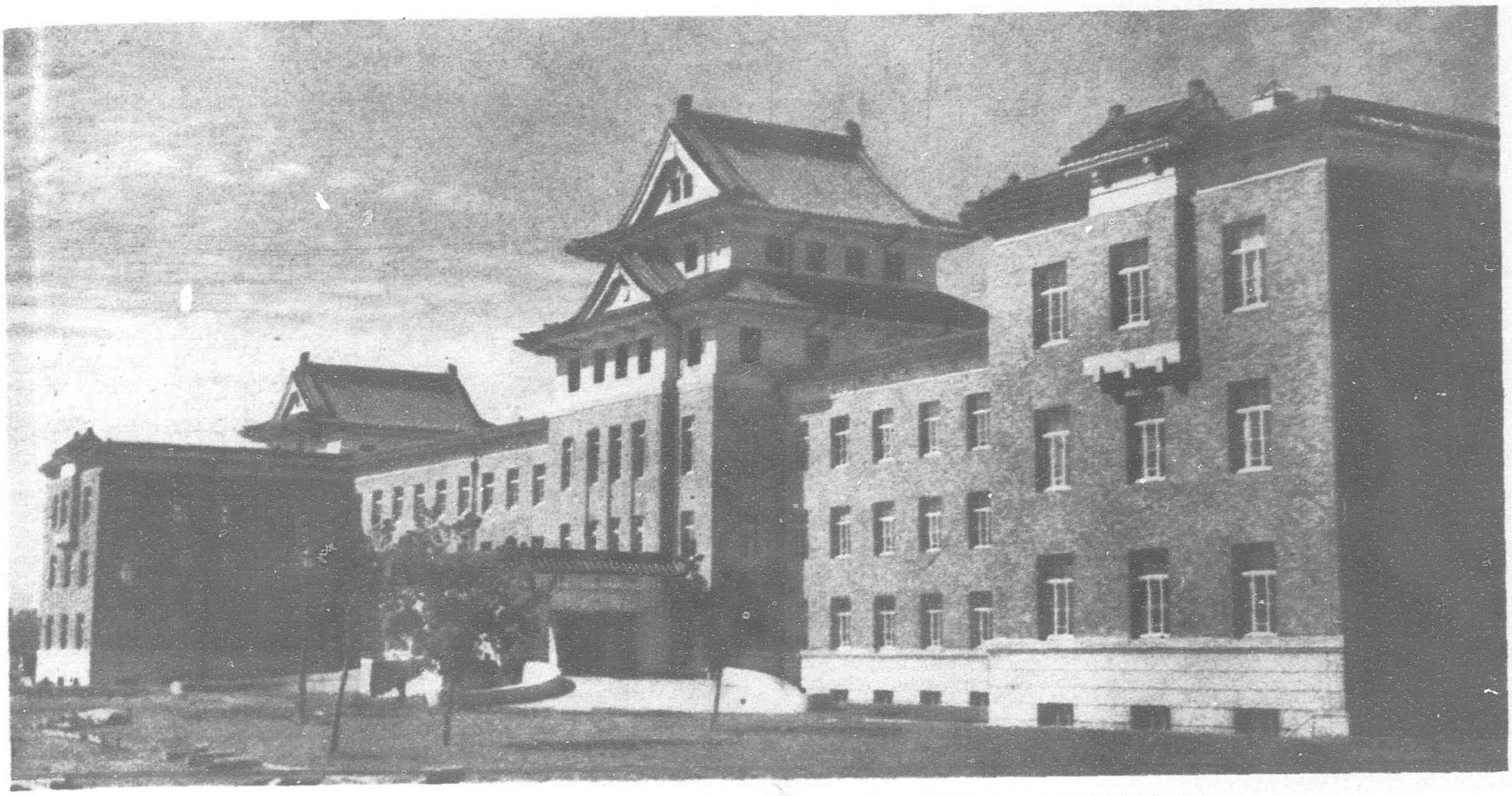
The establishment of the Government of Manchoukuo at Hsinking has necessarily brought forth phenomenal changes in this old provincial railway town. The population has been increasing by leaps and bounds. New houses have sprung up like bamboo shoots after a rain, under the constant urge to mitigate the acute shortage of accommodation. As construction work progressed under the present city-planning project, the hills in the suburbs of the old town have disappeared one after the other. New highways have been cut through and are being constantly extended, while in the newly opened city section, tower modern buildings housing Education, Justice, Foreign Affairs and Finance departments in addition to the bureaus for the capital planning and the state highway construction. Meanwhile other government offices are being erected, not to mention the construction of non-governmental commercial and residential buildings.

Hsinking has already emerged from the tranquil railway town of Changchun that embraced a population of 90,000 to a lively civic center accommodating 210,000 excluding troops. It is still expanding. It is anticipated that Hsinking will have a population of 500,000 in the next 20 years, but if the present rate of increase continues this goal will be reached earlier than expected.

Features of City Planning

In view of the fact that there are many hills in the designated capital areas, the natural lay of the land has been utilized to the best advantage for laying out a number of extensive parks with large ponds and some with special bridle-paths. These parks adjoining the civic center, residential quarters, commercial section and factory areas are not only natural recreation grounds but excellent centers of refuge in times of emergency. With the trees to be lavishly planted along both sides of highways, these large parks will give Hsinking an appearance of a large picturesque park. Together with the sewage and water systems, they will help to make the city a healthy capital. New buildings standardized not to exceed 20 meters in height is another factor that will eliminate whatever discomfort that may result from the construction of skyscrapers, and diminish the potential damages in the event of natural calamities.

The city center having been removed to south as a result of the capital construction, a new central railway station has been erected to serve as the main entrance to the capital, and opened to traffic on October 1, 1933. The building and its facilities are to be substantially improved later. Meanwhile, the South Manchuria Railway's approach to Hsinking is to be lowered beneath the street level to facilitate traffic. As a matter of fact, it is planned to have all railway tracks run under ground within the city limits.



The structure that houses the headquarters of the Kwantung Army in Hsinking

Hsinking will have no electric tramways. Motor buses are to furnish the means of municipal transportation, doing away with the noise and traffic troubles arising from tramways. On all state highways radiating from Hsinking to Kirin, Harbin and Mukden, high speed motor buses will be operated.

It is anticipated that light manufacturing industries will prosper in Hsinking. Comparing Anshan and Fushun to the Osaka and North Kyushu industrial areas, Hsinking's position will be similar to that of Tokyo where light industries predominate and the city will expand with an enormous increase in the population. In Hsinking, all the factories are to be confined to the north-eastern corner of the capital, traversed by the Itung River, on the north side of the South Manchuria Railway and also on the east side of the Hsinking-Tumen Railway, so that the civic, commercial and residential districts will be free from smoke and noise.

Apart from highways, sewage system, and waterworks, the Hsinking airport, municipal athletic stadium, meteorological observatory, and wireless station form an important part of the city planning program. The international race-course and a number of other recreation and sporting establishments are to be operated under the direct management of the central government or the municipality.

Where the finances of Manchoukuo are administered—The new building of the Ministry of Finance

City Planning Program

(1) Population: The population of Hsinking is now about 210,000 excluding troops distributed as follows: Old walled town and commercial section, 141,000; South Manchuria Railway zone, 51,500; Kwanchengtsu, 8,000; others, 8,000.

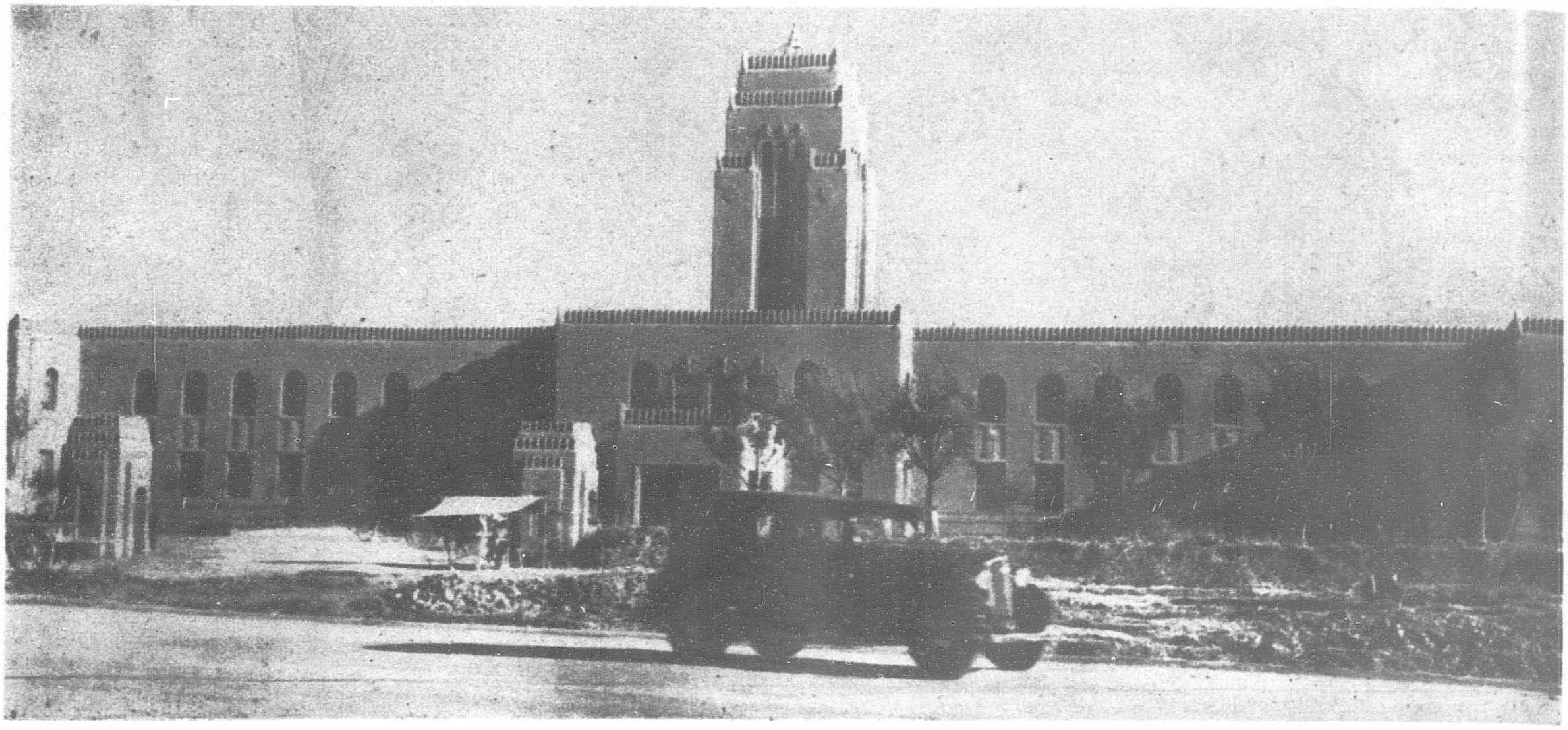
No reliable data exists on the rate of population increase prior to 1931, but it is estimated at five per cent per annum. Since Hsinking became the capital the increase has been abnormal. Government officials and their families alone added 10,000. A conservative estimate of the rate of population increase has been fixed at six per cent annually and will reach 500,000 in 20 years. In view of Hsinking's geographical, political and economic significance the plans for the new capital have been based on the scope of accommodating not less than 500,000 people.

(2) Designated Capital Areas: A rectangular district of about 200 square kilometers in area including the old town of Changchun has been designated as the capital district. The site is much larger than is necessary for present needs.

When this spacious area was designated as the capital site, however, the capital planning officials had in mind the fact that the expansion of a city in the suburban districts and the subsequent annexation of the newly opened sections with the old-city have always given rise to various troubles, and that it is better to provide for such potentialities. With this spacious territory covered by the present capital planning scheme, Hsinking will have no such troubles in the future when the population expands higher than 500,000.

Space Allotments

Of this total of 200 square kilometers, about one-half of the territory comes under the jurisdiction of the present capital planning schemes now in operation. Covered within this territory, however, there are such districts as the South Manchuria Railway zone, the North Manchuria Railway zone, and old city sections where the construction work



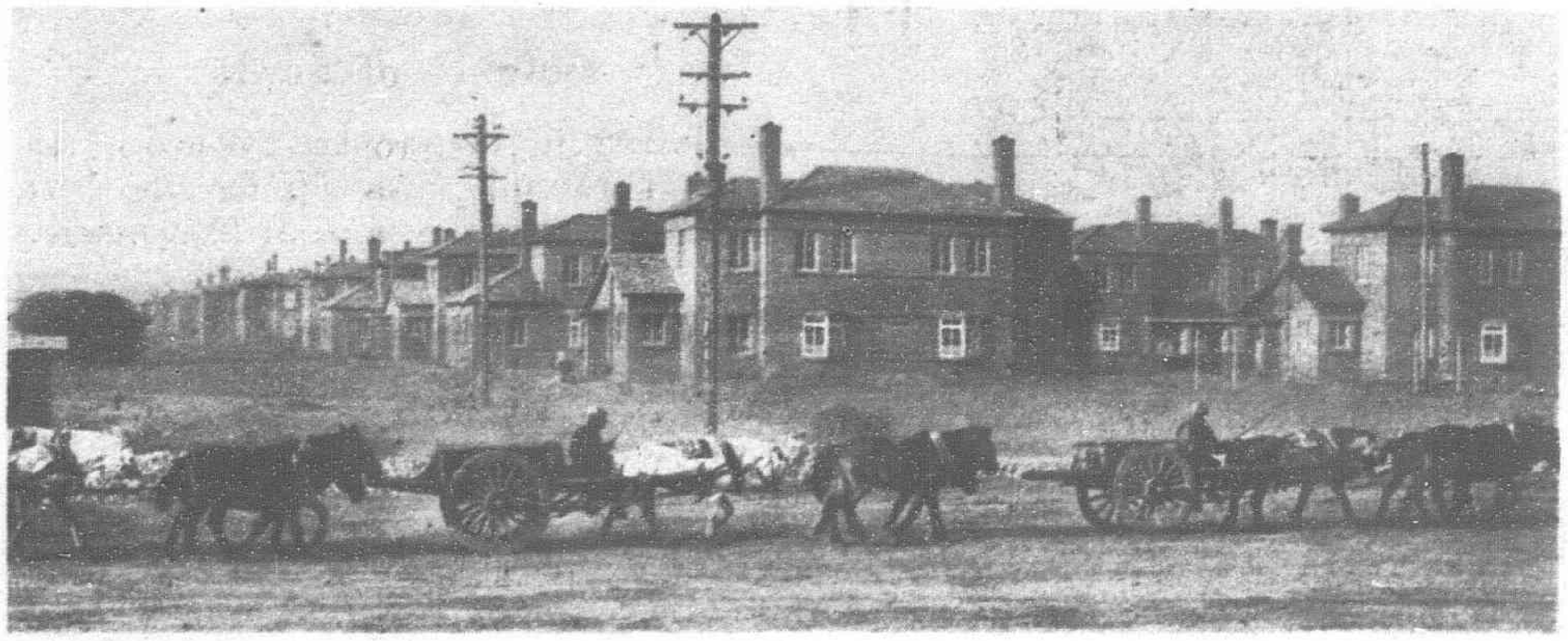
The Ministry of Education and the Capital Construction Bureau are housed in this imposing new building in Hsinking

need not be nor cannot be carried out immediately. With such districts excluded, the area where the actual capital planning work is carried out comes down to about 79 square kilometers.

The allotment of space under the present capital planning projects is as follows: (Unit, square kilometers).

(*a*) Official Purposes:	
(1) Government offices	6.5
(2) Highways	21.0
(3) Public utilities	3.5
(4) Parks, stadium, etc.	7.0
(5) Military requirements	9.0
Total	47.0
(*b*) Private Purposes:	
(1) Residential quarters	27.0
(2) Commercial section	8.0
(3) Industrial areas	6.0
(4) Undesignated	10.0
(5) Special districts (farm and dairy yards)	2.0
Total	53.0
Grand Total	100.0

The foregoing table gives the allotment of space upon completion of the present capital planning. Meanwhile the actual construction work is divided into two phases, the urgent enterprises being covered in the program for the first phase which spreads over a period of five years, beginning in the* fiscal year 1932-33 (July 1, 1932-June 30, 1933).



A section of the new residential district in Hsinking where construction work is in full swing

The work to be completed during the first five years of the present capital planning scheme covers an area of about 20 square kilometers, as follows: (Unit: Square Kilometer).

(*a*) Official Purposes:	
(1) Government offices	2.0
(2) Highways	4.5
(3) Public utilities, schools, etc.	1.5
(4) Parks, stadium, etc.	2.0
Total	10.0
(*b*) Private Purposes:	
(1) Residential quarters	6.5
(2) Commercial section	2.0
(3) Industrial section	1.0
(4) Special areas (farm and dairy)	0.5
Total	10.0

Residential Districts

Mention should also be made of the fact that the residential quarters are classed into four grades: 1st, 2nd, 3rd, and 4th grade; the commercial section, into three groups, i.e., retail, wholesale, and foreign trade sections; the industrial section consists of the semi-heavy industry and light industry sections; special areas are made up of the districts producing vegetables and dairy supplies.

The maximum density of population is fixed as follows:

Residential quarters: 1st grade, 4,000 per one square kilometer (875 square meters for each lot); 2nd grade, 5,000 (770 square meters for each lot); 3rd grade, 10,000 (440 square meters for each lot); 4th grade, 12,000 (330 square meters for each lot).

Commercial section: 12,000.

On the average, the per capita area will be about 180 square meters, which, compared with the conditions prevailing in large cities of the world, is about the average.

All the construction work in the capital areas are to be controlled by the capital planning authorities via the license system.

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*Note: Manchoukuo's fiscal year has been changed to that beginning on January 1 of the calendar year, beginning in 1936.

Stone masons preparing for the construction of a new building near the Manchoukuo Ministry of Justice, whose building is seen in the background. The Ministry of Justice also houses the Foreign Affairs Department for the time being

(3) Highways:

Seven inter-urban highways are to radiate from Hsinking as follows: (Unit: kilometers).

(1) Nungan-Fuyu, 160: (2) Huaite-Kungchulin, 100; (3) Mukden, 270; (4) Itung, 72; (5) Shuangyang, 50; (6) Kirin, 114; (7) Harbin, 235.

As for the municipal highways, they are divided into three kinds, i.e., trunk lines, branch lines, and auxiliary roads. The trunk lines are to have a width varying from 26 to 60 meters; the branch lines, from 10 to 18 meters; feeder roads, less than 10 meters. The arrangement of the trunk and branch highways is the same as those of modern highways in other cities of the world, these having sidewalks for pedestrians and the vehicles running in the middle.

A salient feature of Hsinking's major highways, of which the width range between 45 to 60 meters, is that trees are to be planted on them in four rows. All the 60 meter wide highways are designated to have a promenade in the middle, its width being 16 meters; the promenade is hemmed with trees on both sides; between the promenade and the sidewalks on either sides, there are highways for vehicles, their width being 12 meters each; the sidewalk is 10 meters wide. As for the 45 meter wide highways, the vehicles run in the middle, a space of 16 meter wide; on both ends of the central speed way, there runs in parallel the tree zone of 2.5 meter wide; between the tree zones and the sidewalks, there is one each of highways for slow moving vehicles, each having the width of six meters; the sidewalk is also six meters wide.

Power Lines Underground

All the highways are paved with asphalt, stone, and hard bricks, as the individual cases may require. The sidewalks are covered with concrete plates. The telephone and telegraph lines as well as the electric light and power supply transmission lines are to be underground.

The Tatung and Hsingan trunk highways are already completed, while most of their respective branch highways have taken the shape of streets and are paved in part.

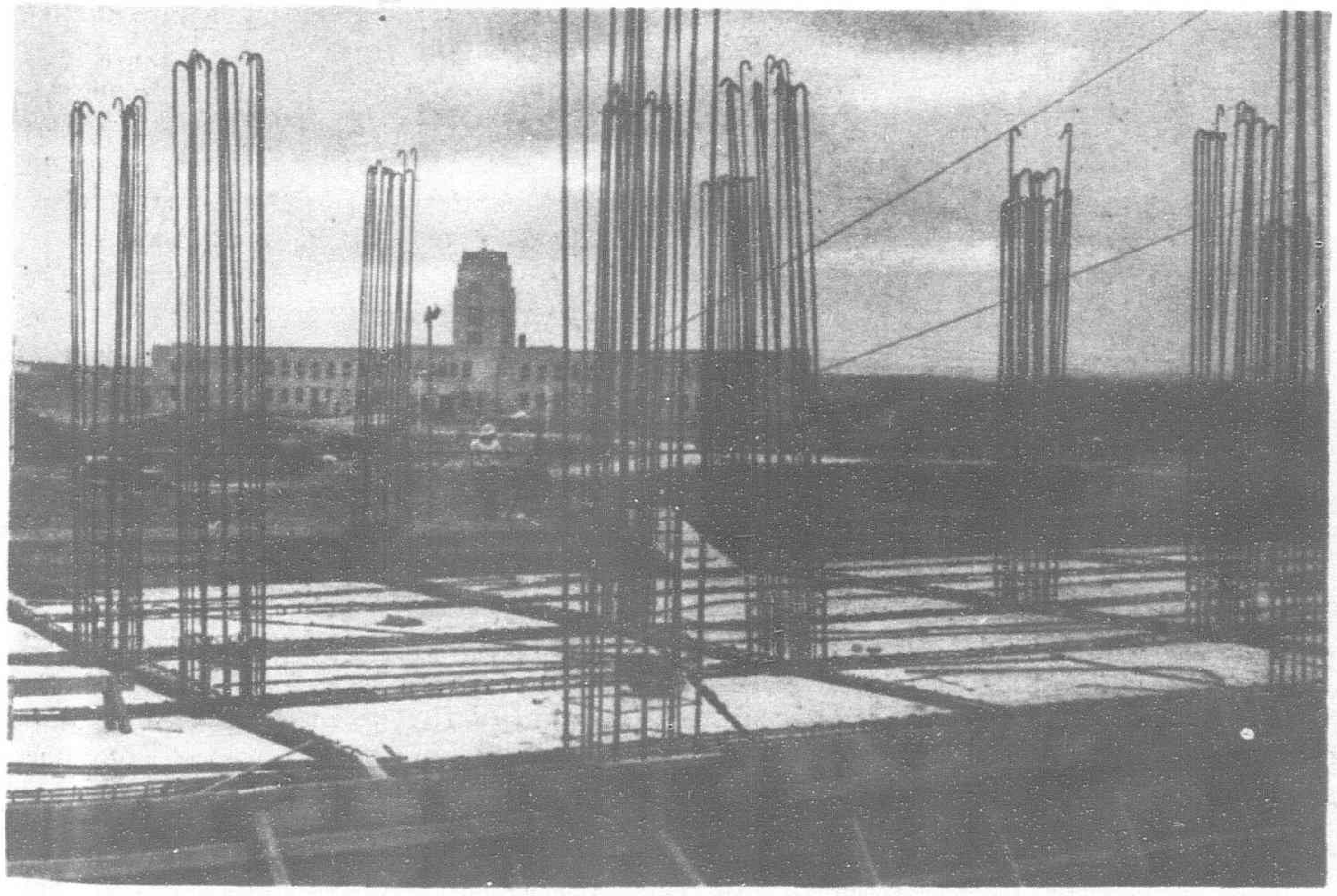
(4) Waterworks:

There has always prevailed a popular fear that the water resources of Hsinking may be short of requirements. And it is true that such apprehensions commanded serious attention in the South Manchuria Railway zone some years ago. This was because the S.M.R. authorities were unable to reach the water resources outside the railway zone under the erstwhile Chang regime. The Hsinking capital planning authorities know, just as the S.M.R. people knew before, that the water resources within and out of the capital areas are abundant.

Under the present capital planning, the population is expected to reach 500,000. In view of the fact that the populations of the S.M.R. zone, Kanchengtse, Hsinking commercial section, and the territory within the city wall total a little more than 200,000, the population is expected to increase by 300,000. The S.M.R. zone and the old city section, however, have waterworks of their own already at present. Consequently, the question at issue is to supply the new city section with 30,000 cubic meters of water daily.

There are three ways of obtaining the necessary water. The one is to tap the subterranean current within the designated capital areas. The second is to obtain a supply from a branch stream of the Itung River. The third is to get the supply from the Yinma River, a branch stream of the Sungari.

An estimate based on surveys carried out in different parts of the capital areas finds that there is a sand stratum beneath the clay layer that covers the ground, and this sand stratum varying in thickness between two and four meters contains the subterranean water which can be pumped out after wells are sunk. In view of the fact that 3,000 cubic meters of such underground water is being pumped out in the S.M.R. zone, it is estimated that 47,000 cubic meters of underground water can be pumped in the 79 square kilometers of the designated capital area. Of this total potential underground water supply, however, 6,000 cubic meters of water is to be pumped under the present capital planning scheme.



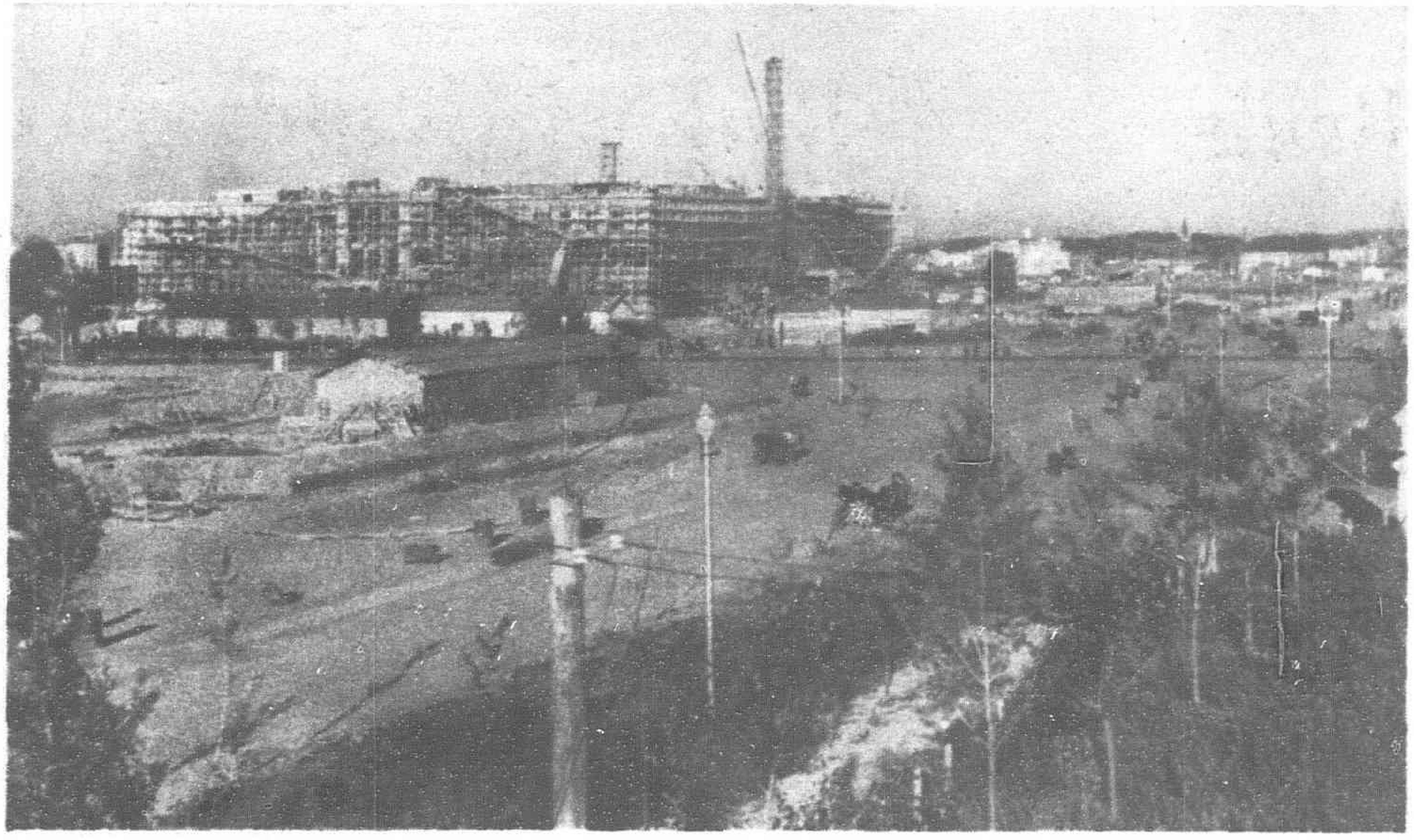
An office building in course of construction at Hsinking. The newly completed Ministry of Education building in the background

Other Sources of Supply

Side by side with the project of obtaining the underground water supply, a spacious reservoir has just also been created at a point 12 kilometers south-east of Hsinking by building a dam on the Hsiaohotai River, a branch stream of the Itung River, the water surface extending to 4.7 square kilometers. From this reservoir, it is possible to obtain 40,000 cubic meters a day.

The combined total of 46,000 cubic meters (40,000 from the foregoing reservoir, and 6,000 from the underground water pumping) is in excess of the estimated requirement of 30,000 cubic meters to supply the new city, and therefore, the old city section and the S.M.R. zone may obtain a supplementary supply to the extent of 16,000 cubic meters a day.

When the population of Hsinking swells substantially above the present goal of 500,000 and it requires more water, all that the capital planning authorities have to do will be to lay water mains for a distance of 40 kilometers to reach the Inma River that flows east of Hsinking. As a matter of fact, plans are already worked out to meet such requirements.


Showing a portion of that section of Hsinking where a business center rapidly is being built up

(5) Sewage System.

Hsinking is divided into nine independent sewage districts in accordance with the geographical conditions. In the districts that incline toward the upper stream of the Itung River, the rain water is permitted to flow into ponds of the neighbouring parks while unclean water is led to the sewage station where the water is cleansed and released into the Itung River because of the fact that there extends the S.M.R. zone and the old city section along the river. In other districts, the rain water and unclean water are let run together along the sewage mains that lead outside the capital areas, eventually reaching the Itung River. The sewage mains laid so far reach well more than 50,000 meters.

(6) Public Welfare Works:

In addition to highways, waterworks, and sewage system, other enterprises designated to promote the public welfare are also making steady progress. Included among these are:

The stock-yard and the dust burning station are created within the factory area. There are one each of the live stock market and the central market in the capital, in addition to retail markets which are created at the rate of one for each 3,000 people. The site for schools and the meteorological observatory is reserved. The museum, libraries, public halls, botanical garden, and zoo are to be created in the park areas. All the principal government offices are erected along the Shuntien Highway. Athletic grounds, race-course and golf courses are to be established in their respective appropriate sites. The parks are distributed in all parts of the capital, their combined total area being seven per cent of the total designated capital areas.

About 10 square kilometers of land is appropriated for military purposes. Included among the construction work to be carried out in this area are: the army barracks, wireless and stations, military and civilian airports.

Manchu girls playing basket-ball in a Hsinking school yard

Manchu girls and youngsters taking a stroll in West Park, Hsinking

CHINESE RAILWAYS

The flotation of the 25th Year Railway Construction Loan of $120,000,000, bearing interest at 5 per cent, was approved by the Nanking Executive Yuan on January 21. The proceeds will be devoted mainly to the construction of a trunk line connecting the provinces of Hunan and Kwangsi, Kweichow and Szechuen. Part will be allocated to the extension of existing lines.

Final touches are being applied to plans for the construction of a railway linking Chengtu, the capital of Szechuen, with Chungking, the leading commercial city of the province. Public bonds to the value of $50,000,000, it is understood, will be floated. Survey work on the projected line, which will be about 120 miles in length, is expected to be completed early in 1938.

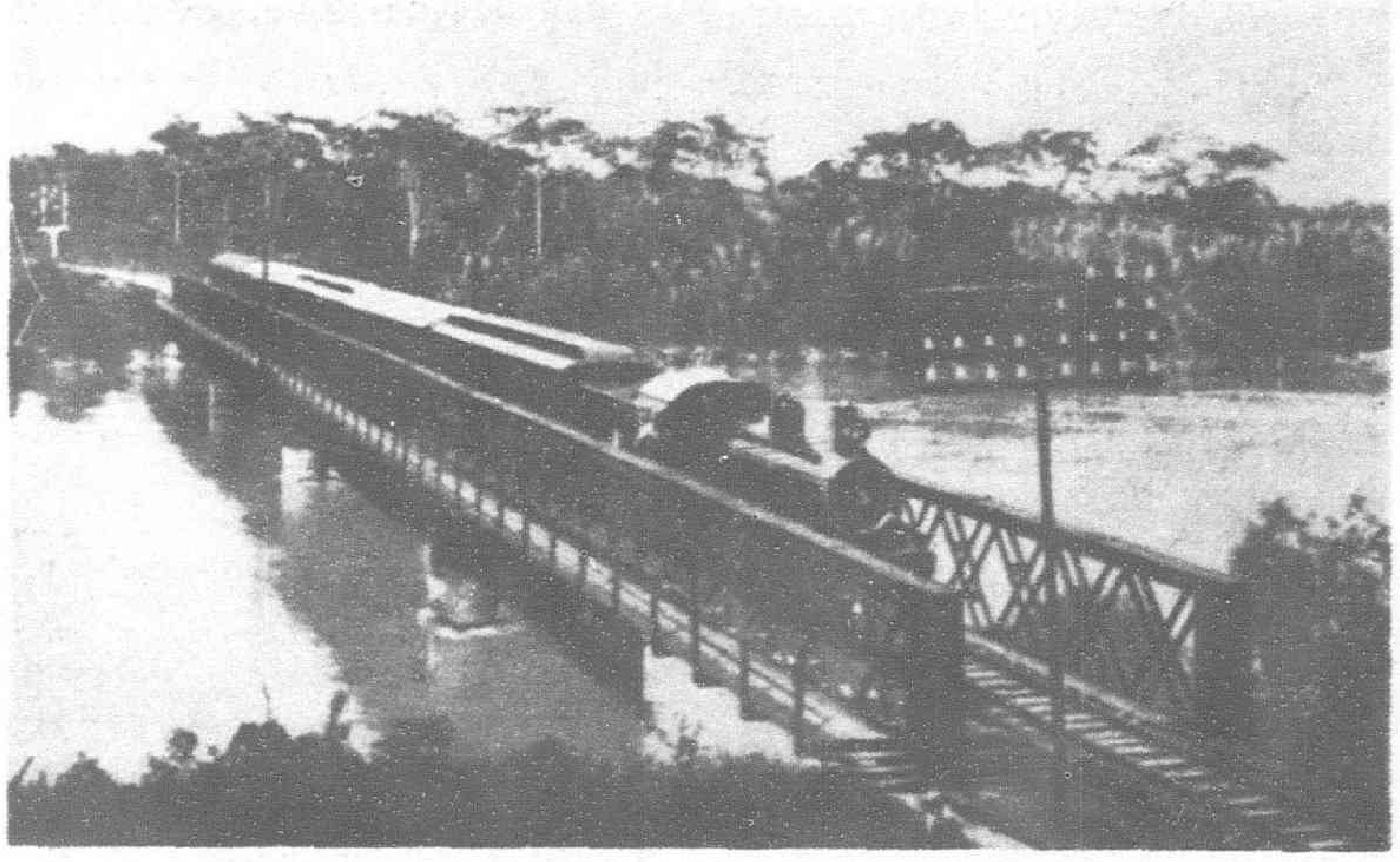
The Lunghai Railway, pushing rapidly towards the west from Sian, capital of Shensi, has already reached Hsienyang. A temporary wooden bridge has been thrown across the Wei River. Construction of a permanent railway bridge has begun. Building this bridge at Hsienyang constitutes a big engineering feat. The river here is nearly a mile wide in flood time, and the greater portion of this stretch will have to be covered by the bridge. By the middle of March the railway will have reached Hsingping, 35 miles west of Sian. The Lunghai Railway gives the north-west direction connection by rail with the new port of Haichow on the coast, and provides an outlet for the huge annual output of cotton and grain and other raw products of the North-West.

Railway Bridges and Railway Buildings in Malaya

(The following article is taken from a historical record covering "Fifty Years of Railways in Malaya" compiled and published by The Federated Malay States Railway Administration).

"There is no worry so considerable as to wail by impassable streams."—**Swinburne.**

In the normal development of a country very little time will elapse before the pioneer finds himself in such deplorable circumstances as Swinburne appears to have experienced. In a progressive state, however, the authorities responsible for its development will not long be content to "wail by impassable streams." So it was in Malaya in the early stages of development and some of the older bridges on the Federated Malay States Railways system are a monument to the zeal and expedition with which the engineers in those days set to work. That there was some "wailing" and perhaps even some "gnashing of teeth" is probable but there is no record thereof in the State archives.



Special train with H.R.H. the Prince of Wales, crossing the Connaught Bridge, March 30, 1922

For instance consider the first railway bridge over the Klang River in Selangor, which was a necessary part of the project to build a railway from Kuala Lumpur to the ancient port of Klang. The river at the point at which it was decided to cross is approximately 500 feet wide and its bed consists of glutinous mud varying in depth from 50 to 80 feet. Having regard to the difficulties which such material engenders when it is proposed to found any permanent structure thereon, it can be said with conviction that this "Stream" would have troubled the poet no little.

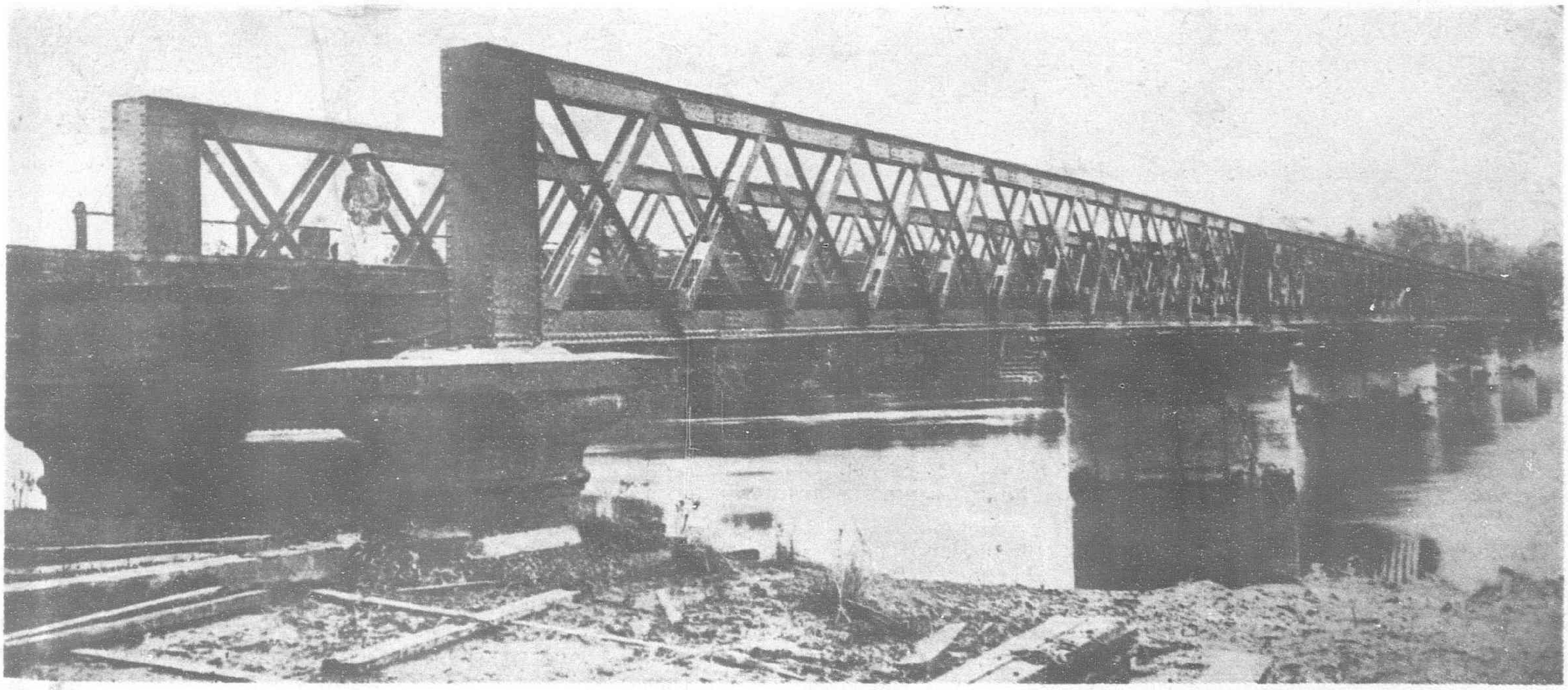
It had been decided to overcome the difficulties arising from the Klang River mud by founding the bridge on vertical cylinders which were to be sunk until they reached a suitable foundation (actually grey sandy clay with odd intrusions of laterite). The first cylinder was pitched on February 4, 1889, the foundation stone being laid by Mrs. Frank Swettenham on April 9, 1889. The bridge consisted of four spans of 100 feet with two 28 feet approach spans, one at either end, the material for which was supplied by Messrs. Head Wrightson & Co., of Middlesburgh and erected on the site by Messrs. Howarth Erskine & Co., Singapore. The bridge was completed and ready for traffic in 1890, and was then ranked the largest engineering work of its kind in this part of the world.

In passing it is interesting to note that the *Selangor Government Gazette* dated March 25, 1889, records the following :—

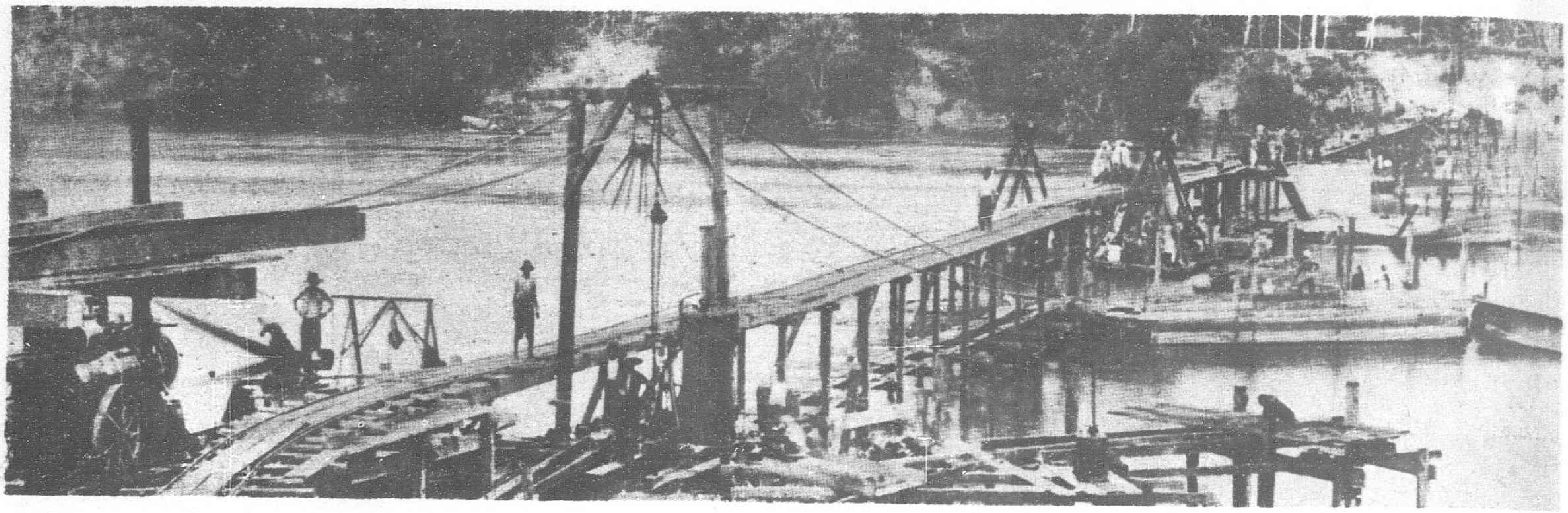
"At the reception at Government House, Singapore, in the evening, His Highness the Sultan of Selangor on his first visit to Singapore was presented to the Duke of Connaught and during the interview which followed asked the permission of His Royal Highness to name the new railway bridge at Klang the "Connaught Bridge" in commemoration of the visit of His Royal Highness to the Straits of Malacca. His Royal Highness in reply said that he accepted the compliment as an additional proof of the loyalty of His Highness the Sultan of Selangor to Her Majesty the Queen and Empress."

And so it came to pass that the first bridge of any magnitude in Malaya was the occasion for a happy expression of loyalty, a sentiment which has lost nothing through being associated with a bridge which, although not in use now, still stands as reminder of that early expression of regard for the Crown.

Selangor did not for long hold the record for the largest bridge. In 1891, the Perak State Government began its development of the railway which was to link Teluk Anson with Ipoh and here again an "impassable stream" barred the way.



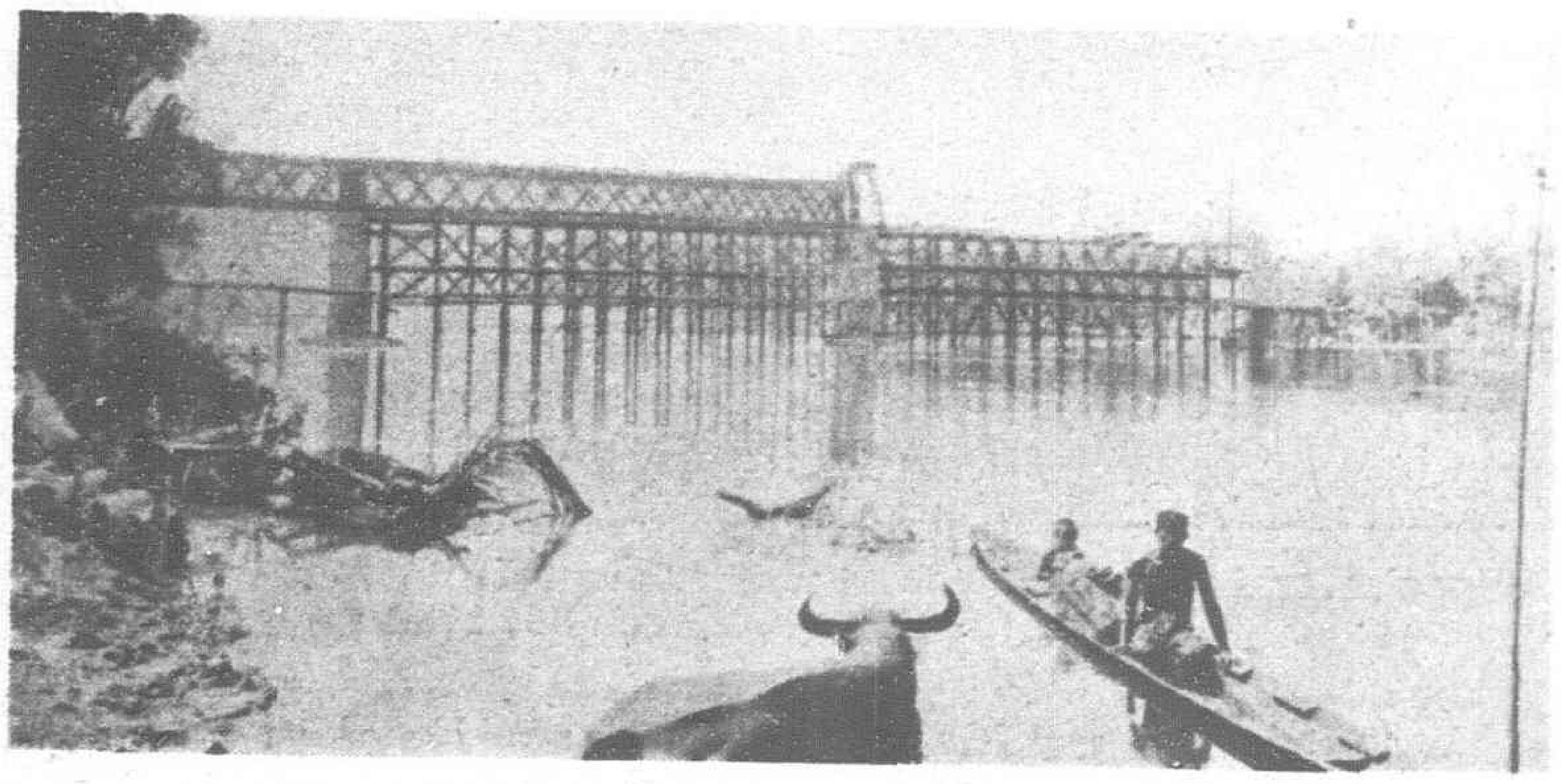
Bidor Bridge from a photograph taken in 1893



Victoria Bridge under construction in 1898

This was the Bidor River close to Teluk Anson and in common with the Klang River presented the same difficulties in respect of foundations. To provide the necessary crossings five spans of 100 feet with two approach spans of 30 feet each were required and so the Selangor record went by the board to the tune of no less than 100 feet. The sinking of the first cylinder was commenced in July, 1891, and by the end of the same year four cylinders had been sunk and one span erected.

Difficulties arising out of late delivery of steel work resulted in considerable delay and the bridge was not completed until March, 1893. The completion called forth no special comment in the official documents of the day and the chronicler has to be content with the engineer's casual remark "completed and opened with the rest of the line in March, 1893."



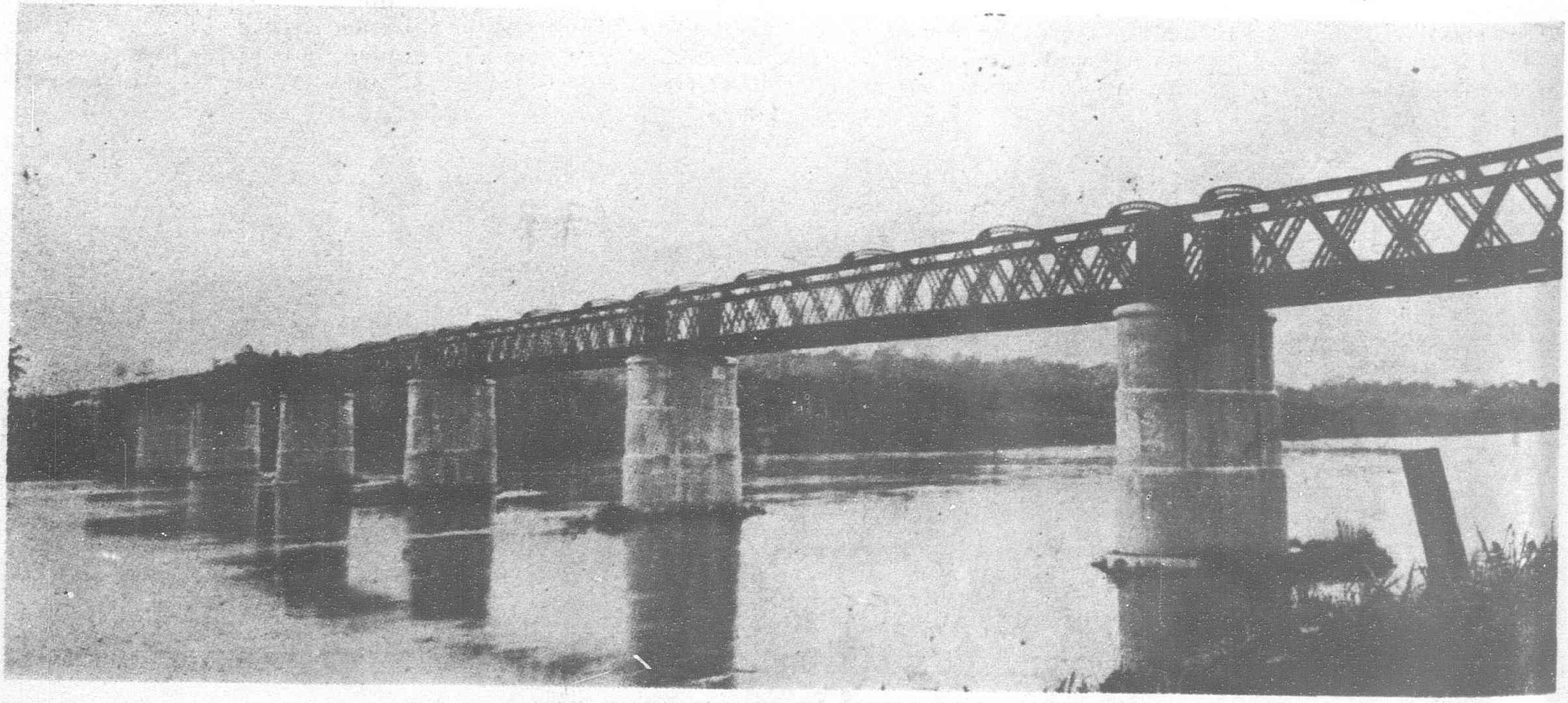
Victoria Bridge under construction in 1899

Having successfully dealt with two of Malaya's "Streams" the pioneers now turned their attention to the crossings of one of her largest rivers, the Perak.

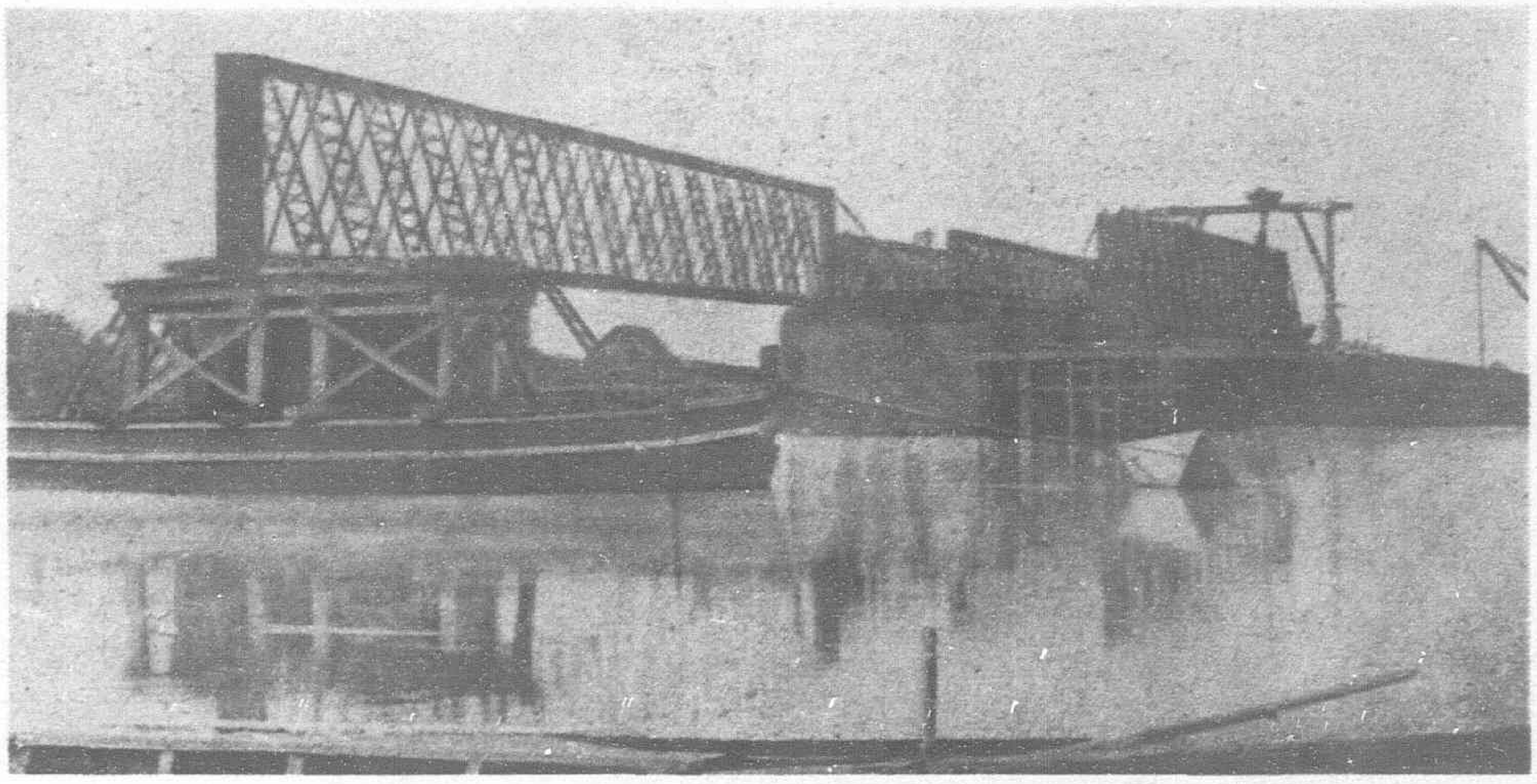
The location of the projected line from Ipoh to Taiping was influenced by the position of Kuala Kangsar and the site for the bridge was eventually chosen at Enggor. The width of the Perak River at this point was upwards of a thousand feet and the final plans for the bridge provided for seven spans of 150 feet.

The mud of the Klang and Bidor was not to be found so far upstream in the Perak River but nevertheless a not inconsiderable problem arose in connection with the height at which rail level should be above the normal level of the river. It was well known in 1897 when this project was under consideration that the Perak River was subject to very high floods in the Enggor District. The local Malay elders were consulted by the engineers and information was forthcoming that the highest known flood level was approximately thirty feet above normal river level.

Preliminary designs allowed for rail level to be 34 feet above this normal but Mr. C. R. Hanson, Resident Engineer, with commendable foresight added six feet to this height. Just how valuable Mr. Hanson's decision was will be appreciated when it is remembered that in the great flood of 1926 the surging waters of the Perak River lapped the bottom booms of the bridge. Had the original rail level been adhered to it is possible, in fact probable, that the bridge would have been washed away and communications in Malaya most seriously affected thereby.



Victoria Bridge (Perak) opened March 21, 1900

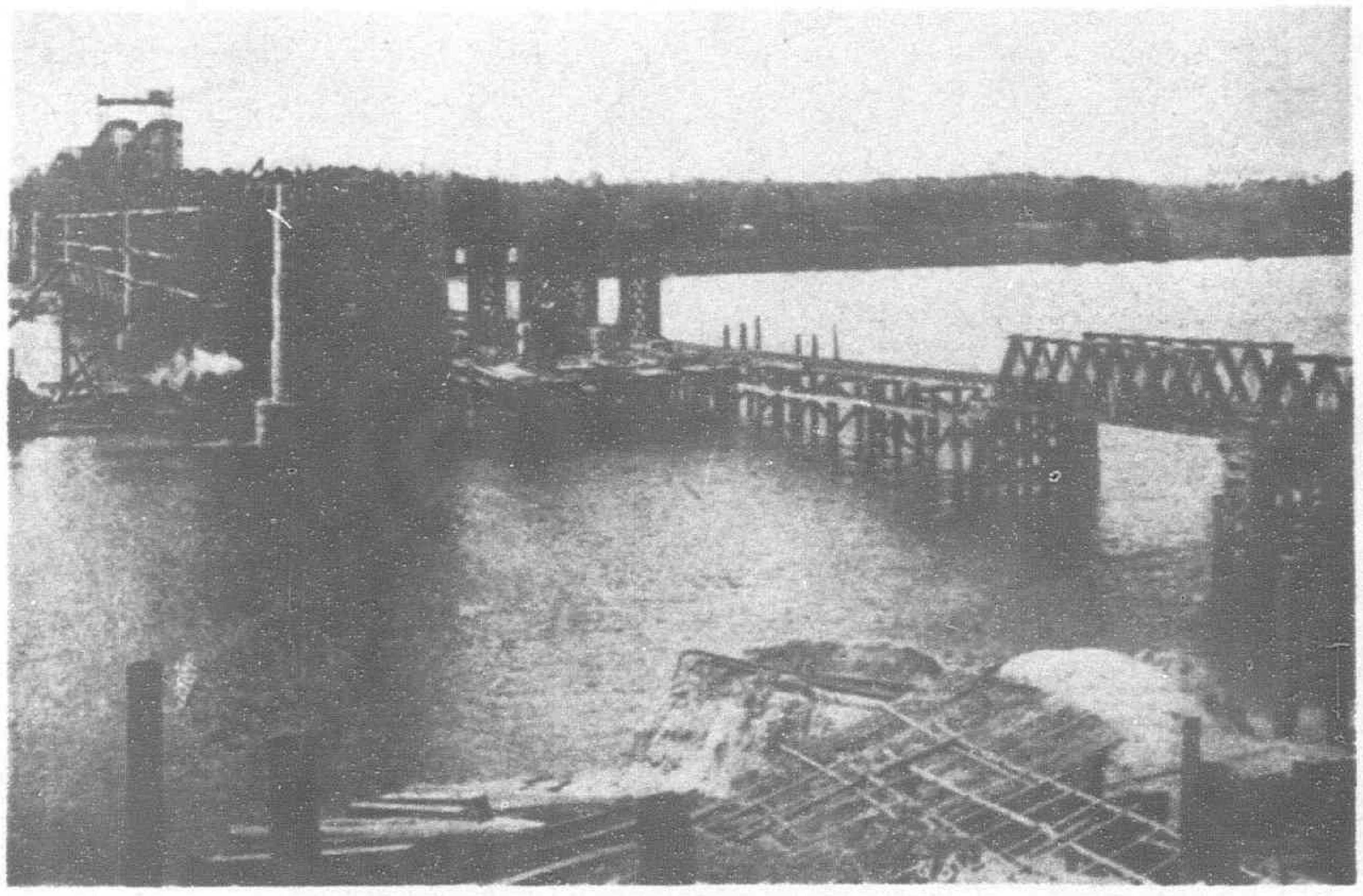


Krian River Bridge under construction, 1899

The preliminary work on this bridge commenced when bores were taken along the center line in April, 1897, at the same time quarters for the staff and the labor force were commenced. Excavation for the foundation of the east abutment commenced in November but in December a very serious flood (thirty feet above normal) was experienced and work was delayed until January, 1898.

The information obtained from the bores referred to above had shown that rock sufficiently hard on which to found was available at an average depth of 17 feet below the bed of the river. In order to reach this rock it was decided to sink wells and the following description of the procedure adopted appears in a contemporary report :—

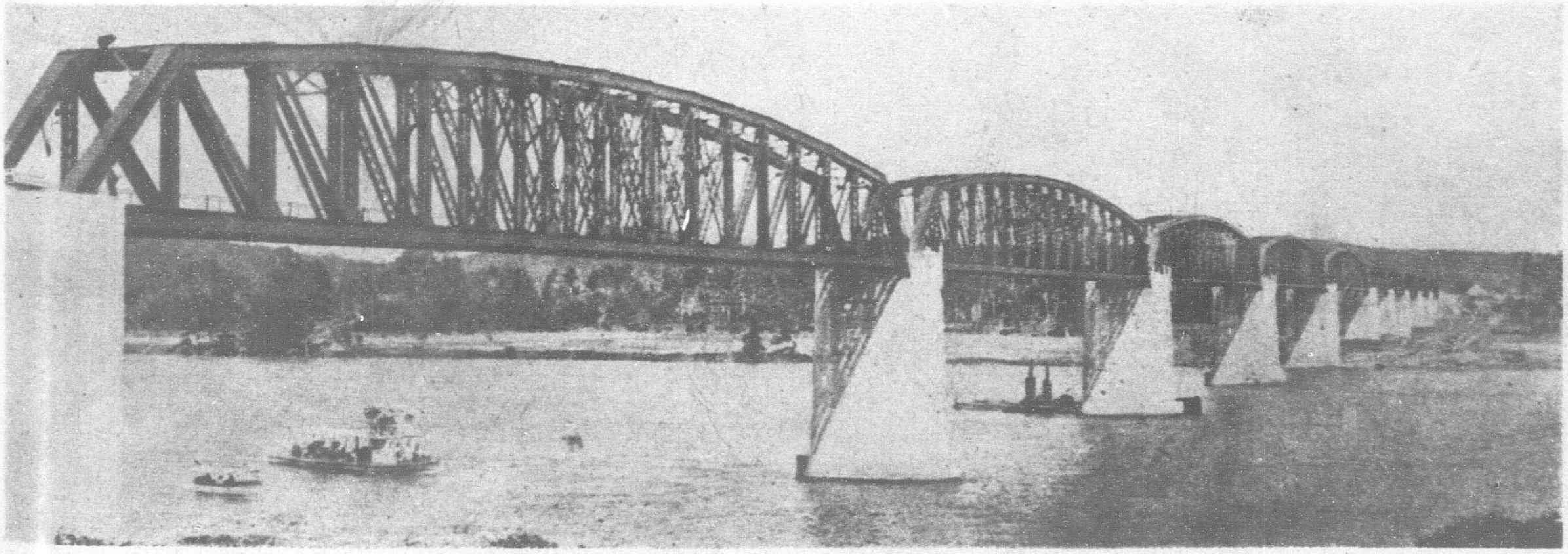
> “ Each pier of the bridge was founded on octagonal wells connected by a diaphragm of brickwork, all resting on steel curbs filled with portland cement concrete. These curbs which were to rest finally on the rock were pitched on artificial islands which had been built at the location of each pier. The brickwork of the wells and diaphragm was built on to these curbs until a height of 17 feet had been reached when the process of sinking was commenced by excavating the material of the artificial island from the center of each well. The weight of the structure thus relieved of the internal pressure caused the whole structure to sink. The natural bed of the river was thus reached and it, in turn, was excavated until rock was reached. As might be expected this rock was not level and had to be chiselled from the inside until a level bed had been prepared on which the curbs could safely be left standing. As the sinking progressed of course, it was necessary to go on building the wells so that when rock was reached by the curb the tops of the wells were above water level, the insides of the wells in the case of this bridge were then filled with concrete at the conclusion of which the building of the piers commenced.”



Guillemard Bridge under construction

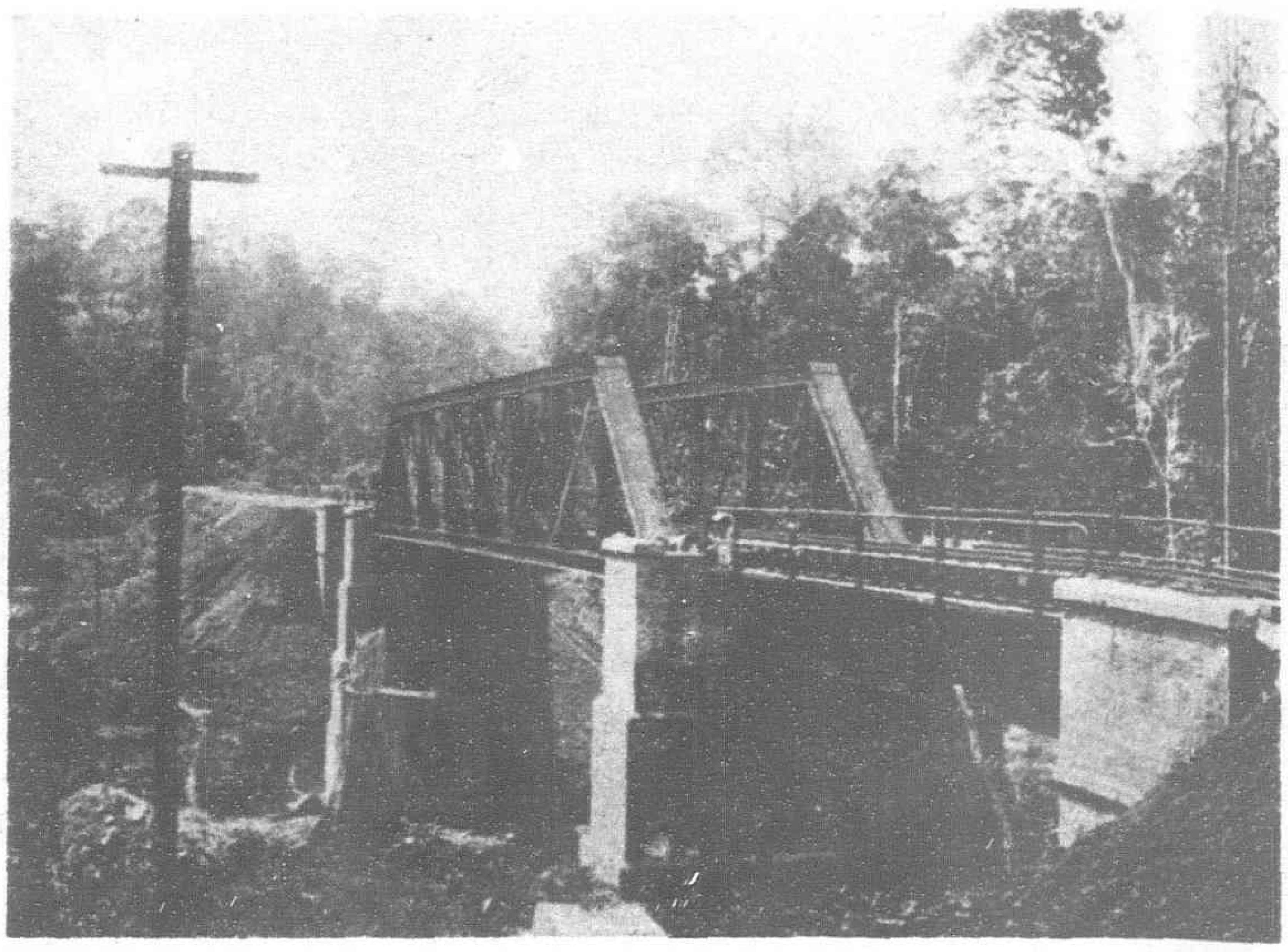
To describe the sinking of foundation wells in so few words may give the impression that the process is relatively simple. It should be remembered, however, that the undisturbed bed of a large river may contain many almost insurmountable obstacles owing to the common occurrence of old trees and large boulders and the like which have rendered the sinking of wells under such circumstances one of the most difficult problems which the civil engineer is called upon to overcome. Such obstacles were met with constantly during the sinking of the wells for this bridge and the engineer's difficulties were further increased by another flood in November, 1898. Nevertheless the foundation work which involved the sinking of no less than 20 wells under adverse conditions of flood was completed in 15 months and the bridge itself would have been ready for traffic during 1899 if the delivery of the steelwork had not taken 15 months instead of six months as had been expected.

That the desire to create records was not unknown in the 'nineties is evidenced by the fact that the sixth span (150 feet containing 150 tons of steel) was erected and riveted within 19 days of its arrival on this site—a record which compares very favorably with the erection and riveting of a 250 feet span (287 tons) in 17 days in Kelantan during 1931. In comparing these two records it must be borne in mind that in the latter

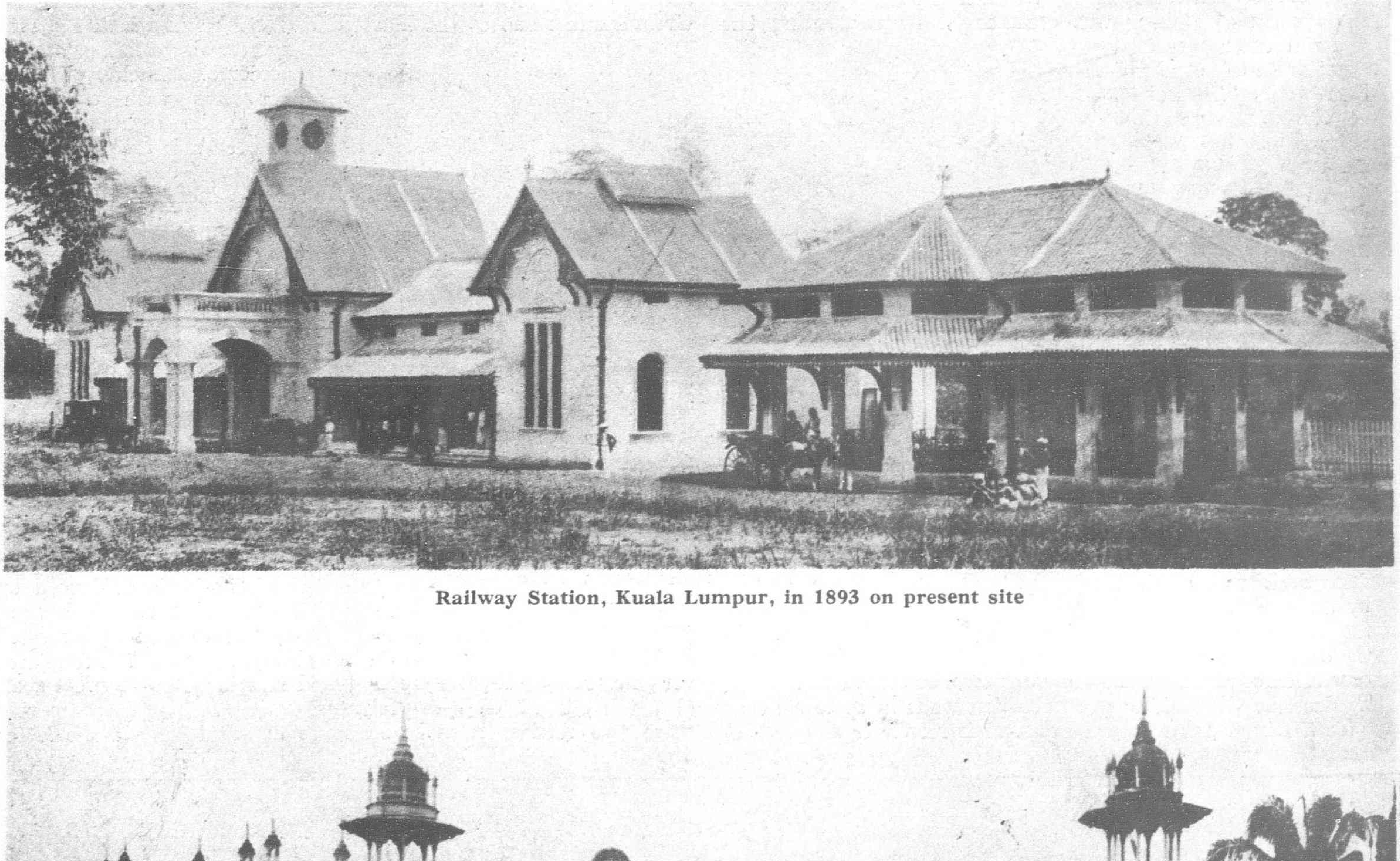


Guillemard Bridge spanning the Kelantan River—finished in 1924

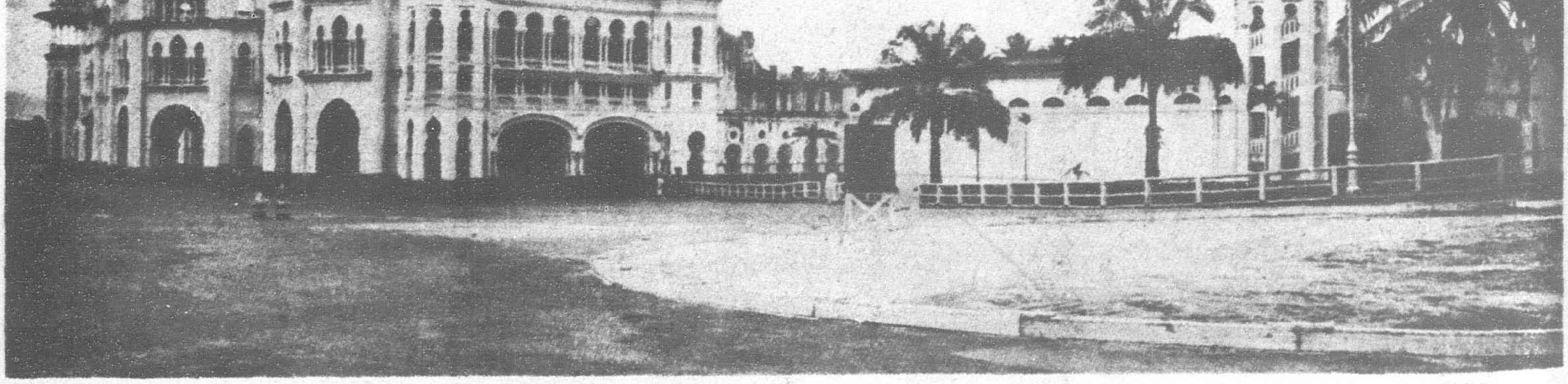
Kemubu, showing part of Peel Bridge



A typical railway bridge in Pahang (East Coast Railway)



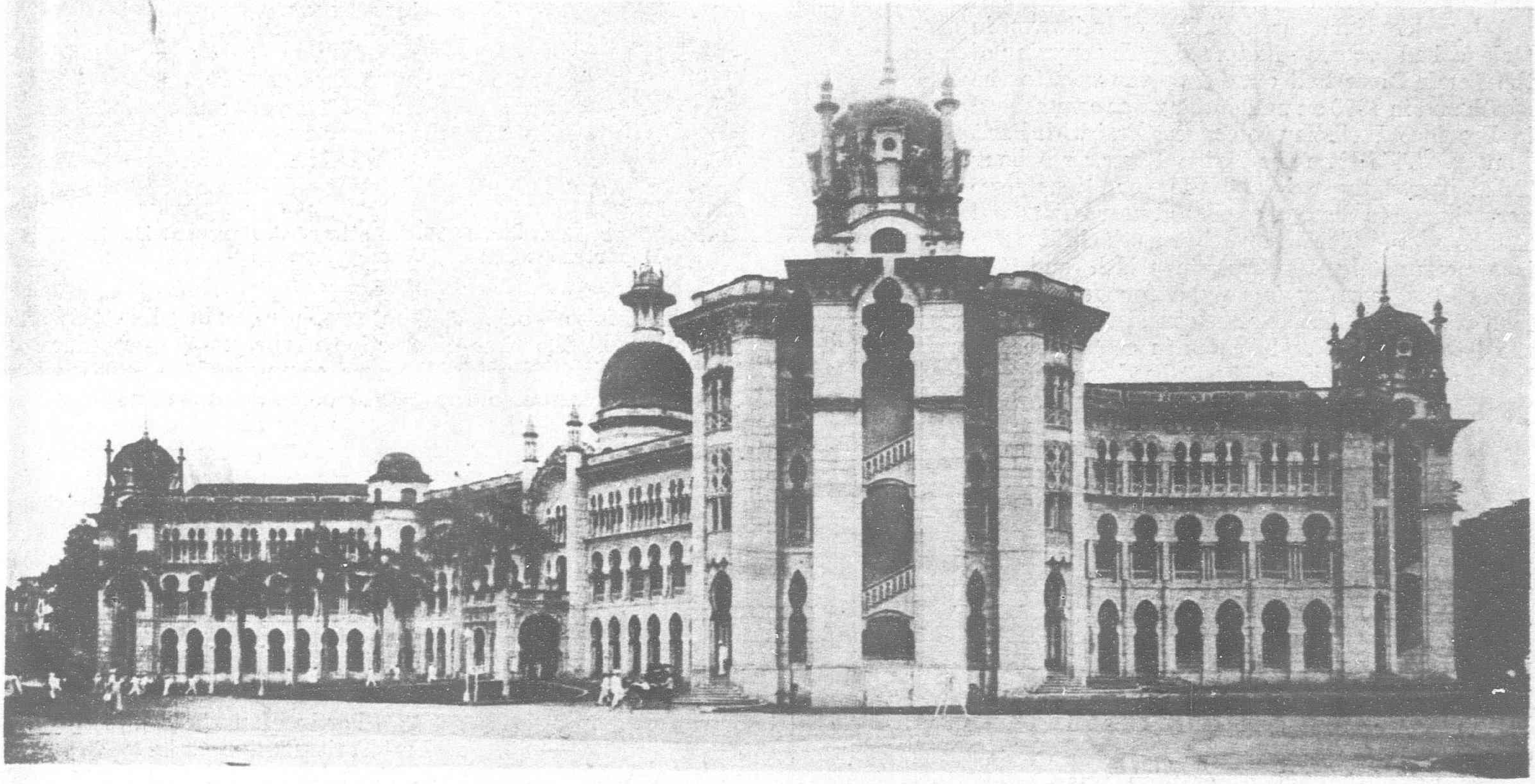
Railway Station, Kuala Lumpur, in 1893 on present site



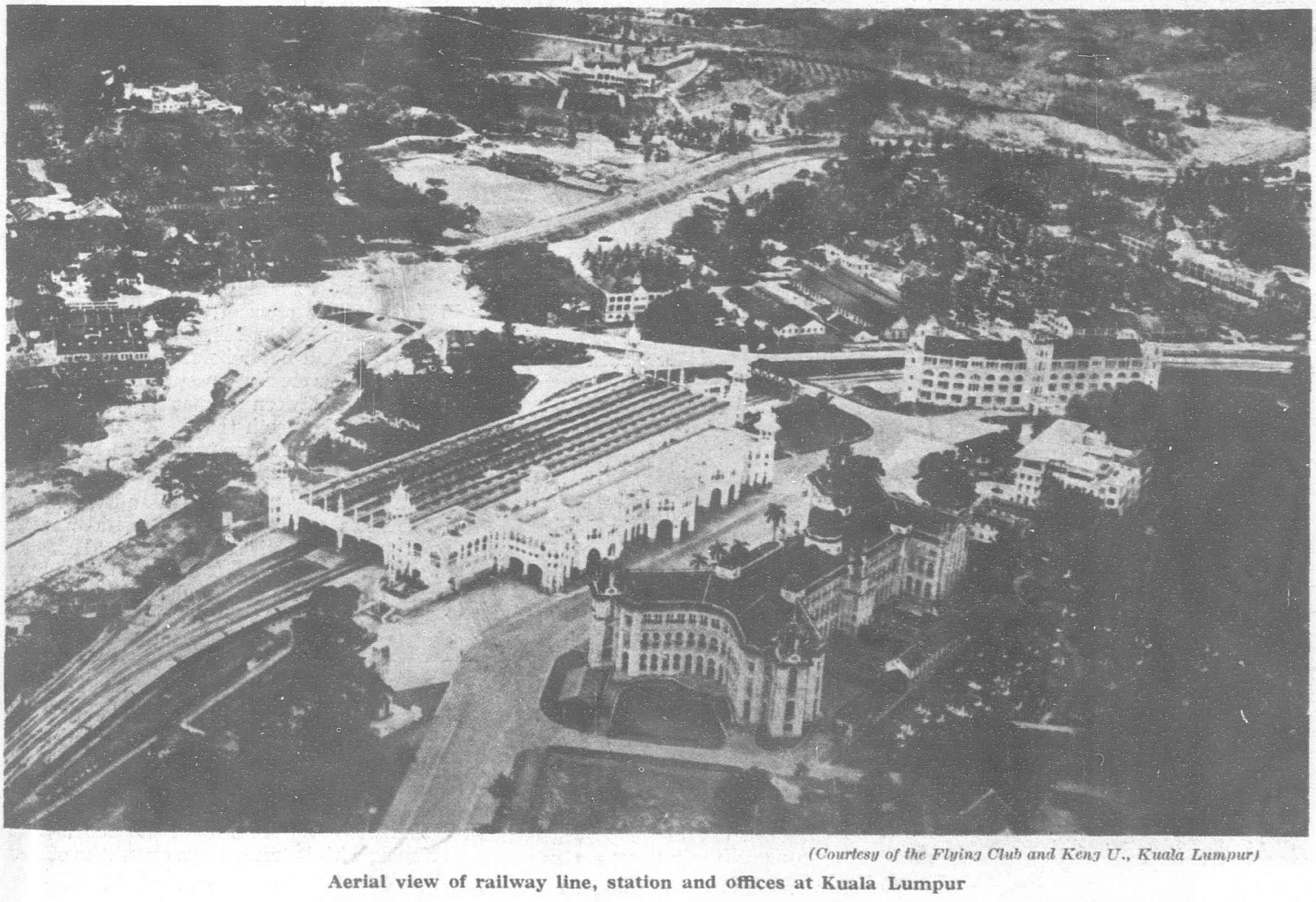
The present Railway Station at Kuala Lumpur case a considerable amount of the riveting was done with pneumatic tools.

A further example of the foresight of the engineers at that time is apparent when it is revealed that the main girders of this bridge did not require to be strengthened in a recent strengthening program although they were called upon to support loads at least 200 per cent in excess of those in operation in the year 1900.

The engineer in charge records that between the time of commencement and completion the price of steel increased by almost 100 per cent and that the cost of erection was enhanced by the fact



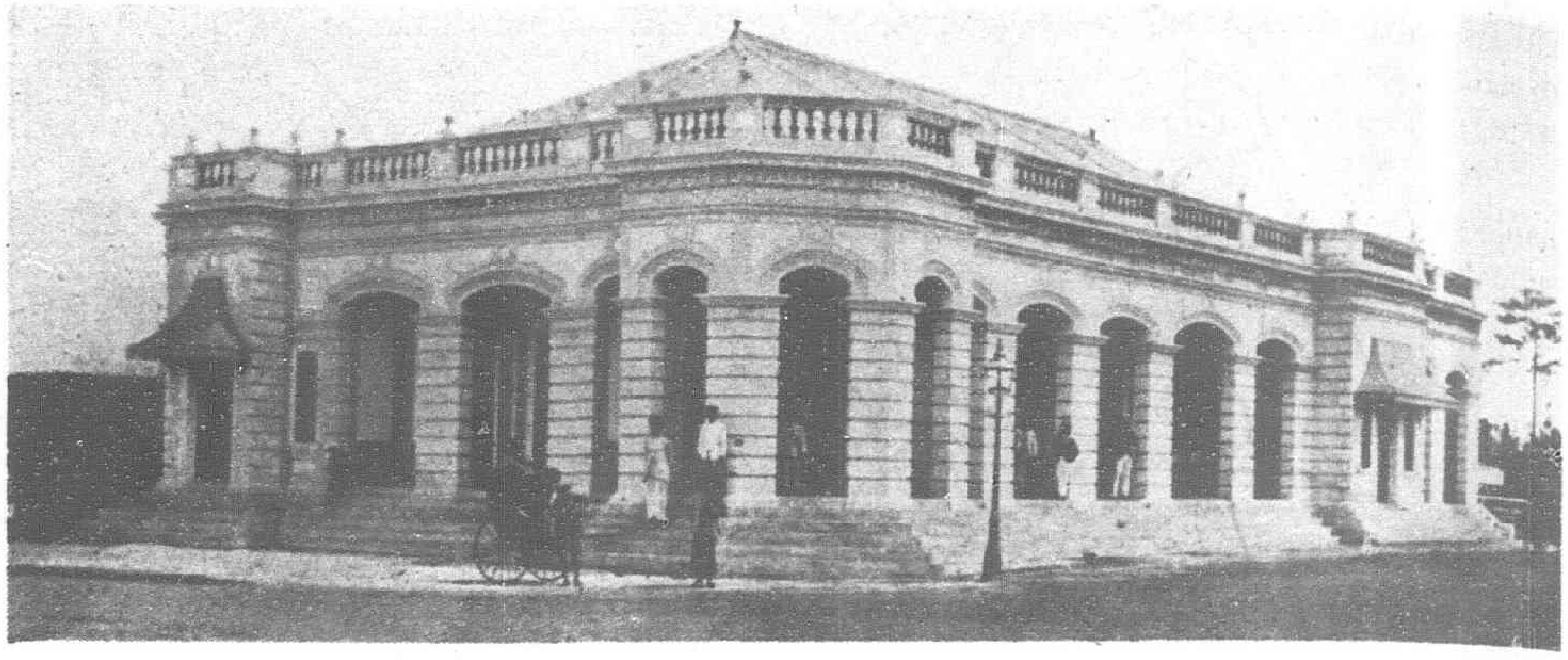
Railway Head Office at Kuala Lumpur to-day (Opposite Railway Station.)



(Courtesy of the Flying Club and Keng U., Kuala Lumpur)

Aerial view of railway line, station and offices at Kuala Lumpur that considerable financial inducement had to be offered to the labor force to prevent it from departing *en bloc* to the neighboring tin mines which were then flourishing.

The bridge was finally opened on March 21, 1900, and named Victoria Bridge in honor of Her late Majesty Queen Victoria.

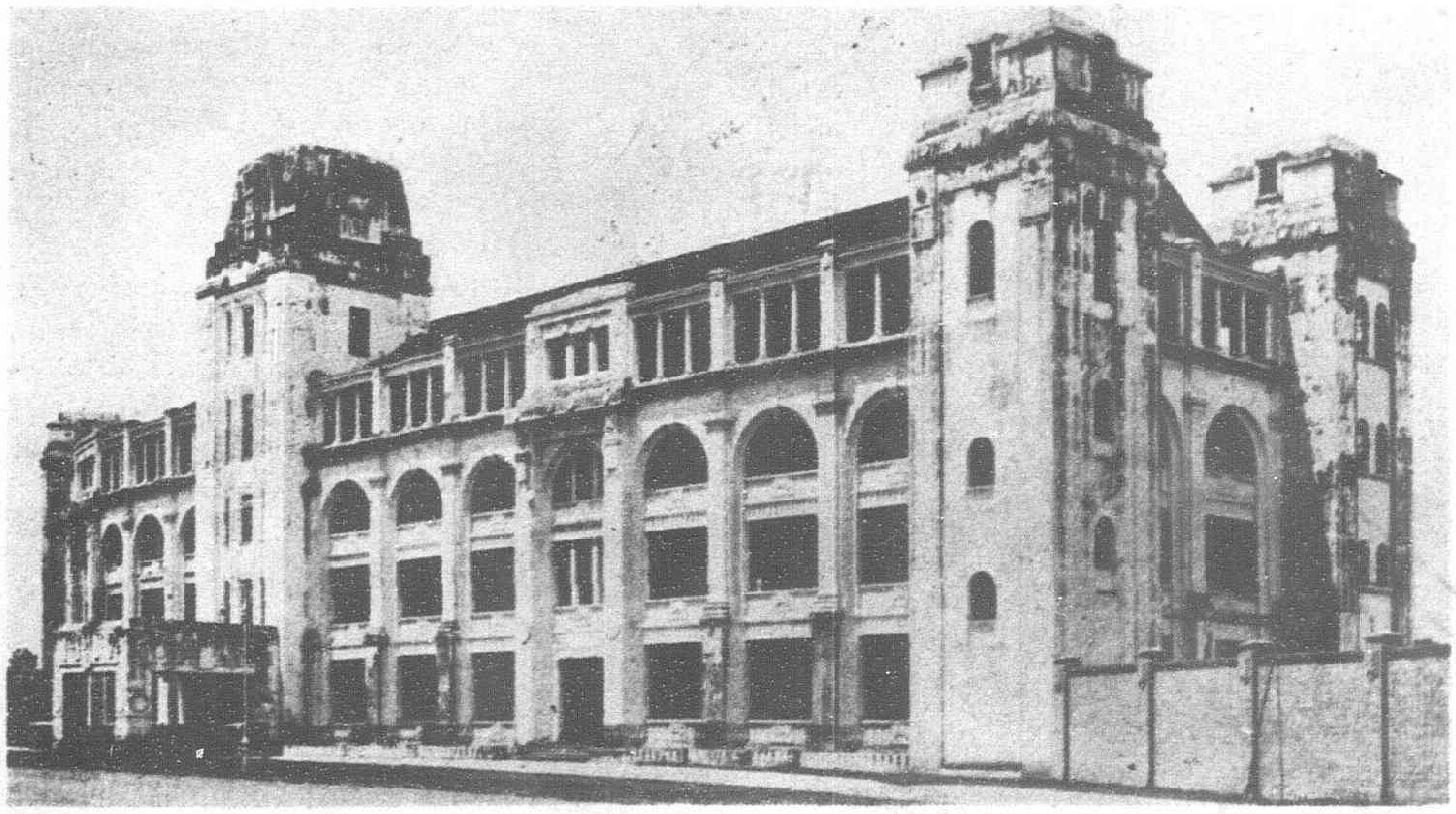

Railway Head Office, Kuala Lumpur, 1895, on site of the present Public Works Department offices, Victory Avenue

By this time the building of railways in Malaya had become widespread. The crossing of the Perak River had opened up the way to the North and in 1898 an undertaking was commenced in Province Wellesley to connect Prai with Parit Buntar. This time the Krian River at Nibong Tebal barred the way and the conditions were very similar to those encountered near Klang and Teluk Anson. The Krian River at the bridge site is approximately 400 feet in width and the surrounding country is only a few feet above high tide level. There was considerable traffic on this river in the late 'nineties, and it was in consequence necessary that the bridge should provide sufficient head room for the craft then using the river. For this reason it represents an unusual appearance to-day since it is approached on either side by long tapering embankments which were necessary to permit of the bridge being located at 20 feet above high tide.

The bridge was built to a plan which provided for two spans of 150 feet with one approach span of 100 feet at each end. As in the case of the Klang and Bidor River bridges the Krian River bridge was founded on cylinders which had to be sunk through 40 feet of mud before they reached sufficiently reliable strata.

Railway Station, Penang

A novel method of erection was employed for the steelwork ; a method which to-day is frequently adopted in tidal rivers. It consisted of erecting the main girders of each span on barges moored to the bank of the river. When all the riveting was complete the girders were floated out into the stream at such a state of the tide that the bearings were a few feet above the level of the tops of the cylinders on which they were finally to rest. Having manœuvred the barges into correct position so that the center line of each girder coincided with the center line of the cylinders, the floating craft were then moored and the superstructure allowed to descend upon the cylinders as the tide went down. The advantage of this method in such a river as the Krian is very marked inasmuch as it dispenses with the need for expensive false work. A photograph reproduced in this article and taken at the time of erection illustrates the procedure.


Suleiman House, Kuala Lumpur

The Krian River bridge was commenced in 1898 and was completed at the end of the year 1900. The embankment approaches referred to above, however, gave so much trouble owing to settlement that the line was not opened out to Parit Buntar until 1901. These embankments continued to subside and it became necessary in 1905 to replace a portion of the northern embankment with an extra 100 feet span which span follows the grade of the embankment (1 in 100) and by reason of this adds further to the unusual appearance of the bridge.

Shortly after the completion of the Prai-Parit Buntar Railway the various sections began to link up and in 1903 Kuala Lumpur was in direct communication by railway with Prai. During this time development to the south of Kuala Lumpur had also been very much in evidence, but with one exception no bridges of any magnitude were necessary. The exception occurred on the Johore State Railway at the crossing of the Muar River near Buloh Kasap. Unfortunately no details are available concerning the building of the bridge at this crossing, all that is known is that it was founded on wells after the manner of the Perak River bridge and that it consists of six spans of 100 feet each.

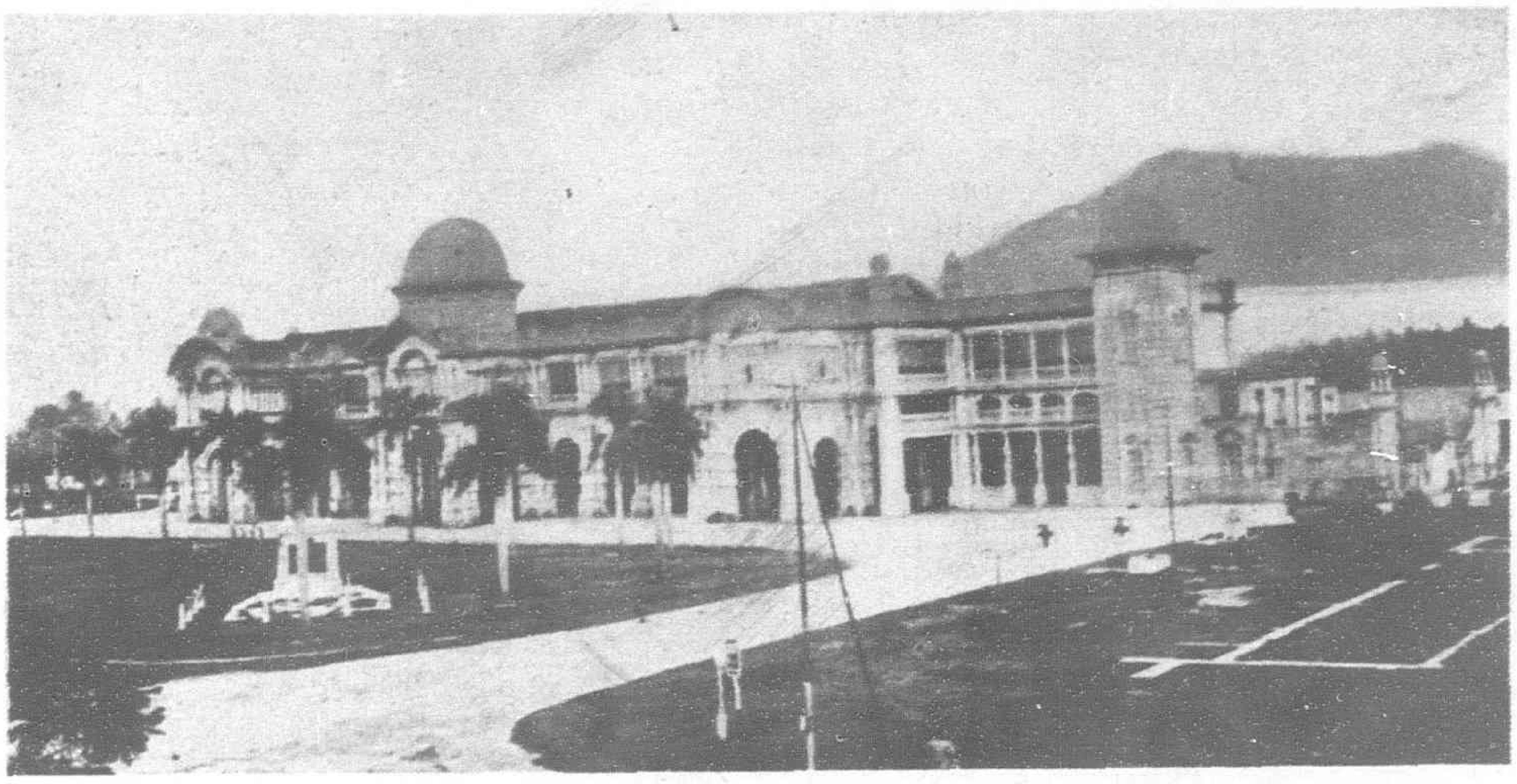
In the year 1907 the construction of the East Coast Railway starting from Gemas was put in hand and there began in consequence such a building of bridges as had never before been contemplated. So many river crossings occurred in the 327 miles of railway between Gemas in the south and Tumpat in the north that it is quite beyond the scope of this article even to mention them all or to refer to them in chronological order.

The crossing of the Kelantan River at Sungei Kusial has provided Malaya with its largest bridge, the "Guillemard," named after Sir Laurence Guillemard. This bridge has five main spans of 250 feet each and five approach spans of 150 feet each, the total length being approximately half a mile. It contains in its superstructure 3,000 tons of steel and in its foundation and piers approximately 20,000 tons of masonry.

Next in order of size on the East Coast Railway is the Manek Urai bridge consisting of two 250 feet spans and three 150 feet spans. The two larger spans were washed away in the 1926 flood when the Lebir River, a tributary of the Kelantan River rose 60 feet above normal, bringing with it tremendous quantities of floating timber and debris which piled up against the girders and caused the two 250 feet spans to overturn and fall into the river. These spans were replaced by two new spans in 1927.

The bridge over the Galas River at Kemubu, named the Peel Bridge after Sir William Peel, suffered a similar fate in 1931 and was replaced by a deck span structure during 1932.

These two disasters would suggest that the rivers of these States have resented the attempts to cross them. In the case of the Western system all the difficulties seem to have been met and overcome in the building of bridges whereas on the Eastern side the problem is not so much to build a bridge as to keep it in place when it has been built. Such a problem is in keeping with the wild nature of the country in Pahang and Kelantan, through which the Eastern system has been driven, at such tremendous cost, and there is nothing prophetic in the statement that the mighty rivers of Pahang and Kelantan have not yet given up the fight, and that " wailing by impassable streams" although the proper occupation of the less fortunate dead may yet prove to be the lot of the equally unfortunate living!



Railway Station, Ipoh

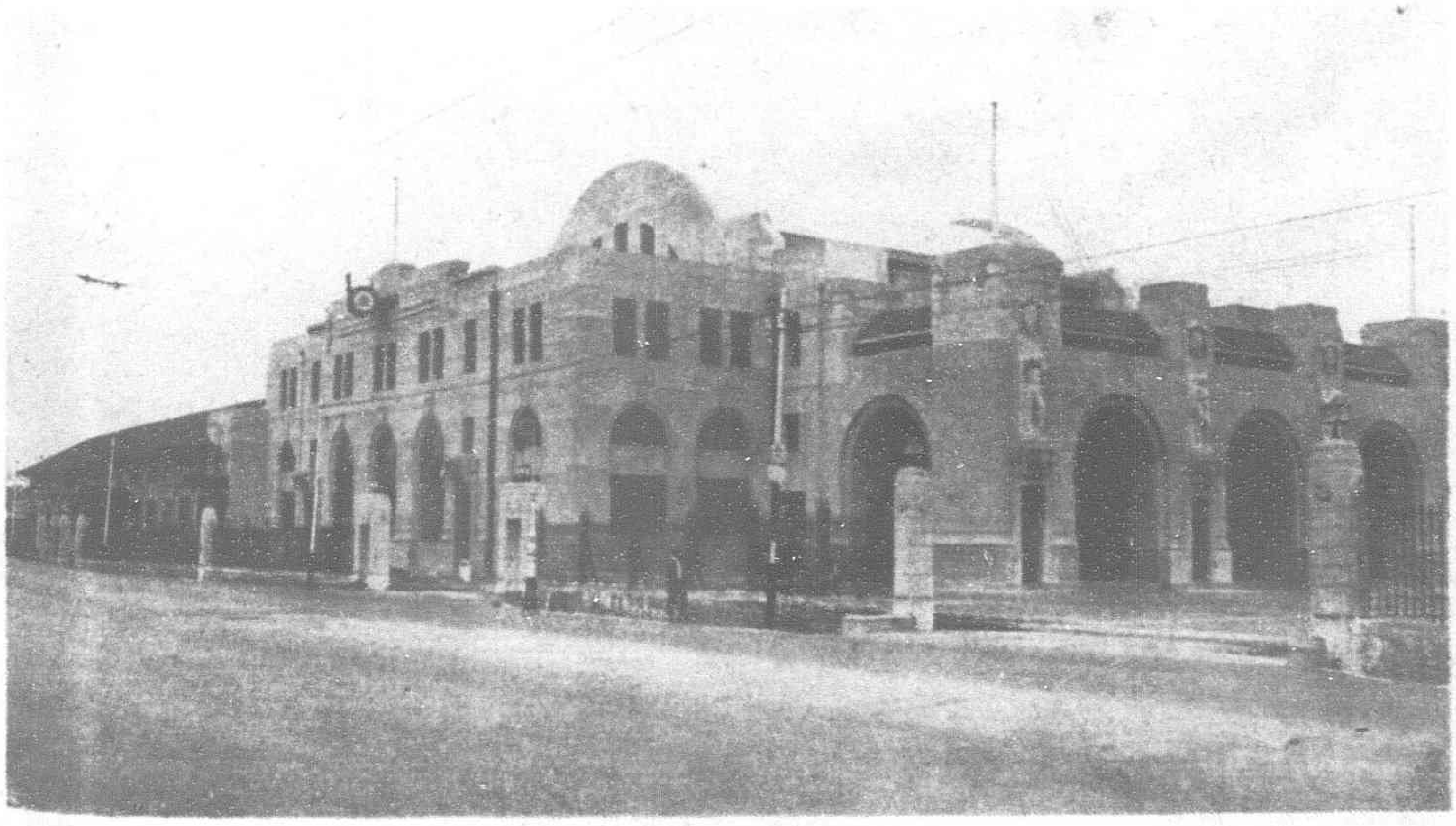
The Station Building, including the Hotel, and the Central Railway Offices immediately opposite are two of the finest buildings in Kuala Lumpur. Both were built at a period when the railway was rapidly expanding to meet the changing conditions. The original station, which was of very modest dimensions, was some little distance north of the present site and was built in 1886 on the opening of the first railway from Kuala Lumpur, *viz.*, the Kuala Lumpur to Klang Line. This served until the Rawang section was opened in 1892 when a new and more commodious building was erected on approximately the same site as is occupied by the present building. Owing to the steady growth of the railway system and of the town itself, station accommodation was again found inadequate and it was then decided to construct a building on much more ambitious lines which would be of a capacity to meet all requirements for many years and the present building is the result. It consists of three platforms completely roofed in, and commodious offices, waiting halls, etc. The hotel containing 30 bedrooms, restaurant, bar, etc., is part of the same building. The building was designed by the Government architect and built on contract and was opened to traffic on August 1, 1910, and extended some years later.

Old Singapore (Tank Road) Station, 1910

Central Railway Offices, Kuala Lumpur

These are immediately opposite the station and were completed in 1917. Plans were prepared by the Government architect for this building as early as 1913 and the contract was let in 1914, but owing to the War work proceeded slowly and the building was not completed until November, 1917. It is interesting to note that tenders for this work were called not only in the F.M.S. and S.S., but also in India, as at that time few buildings of such size had been attempted by local labor. The contract was secured, however, by a local Chinese firm and was satisfactorily carried out. The cost was just under half a million dollars.

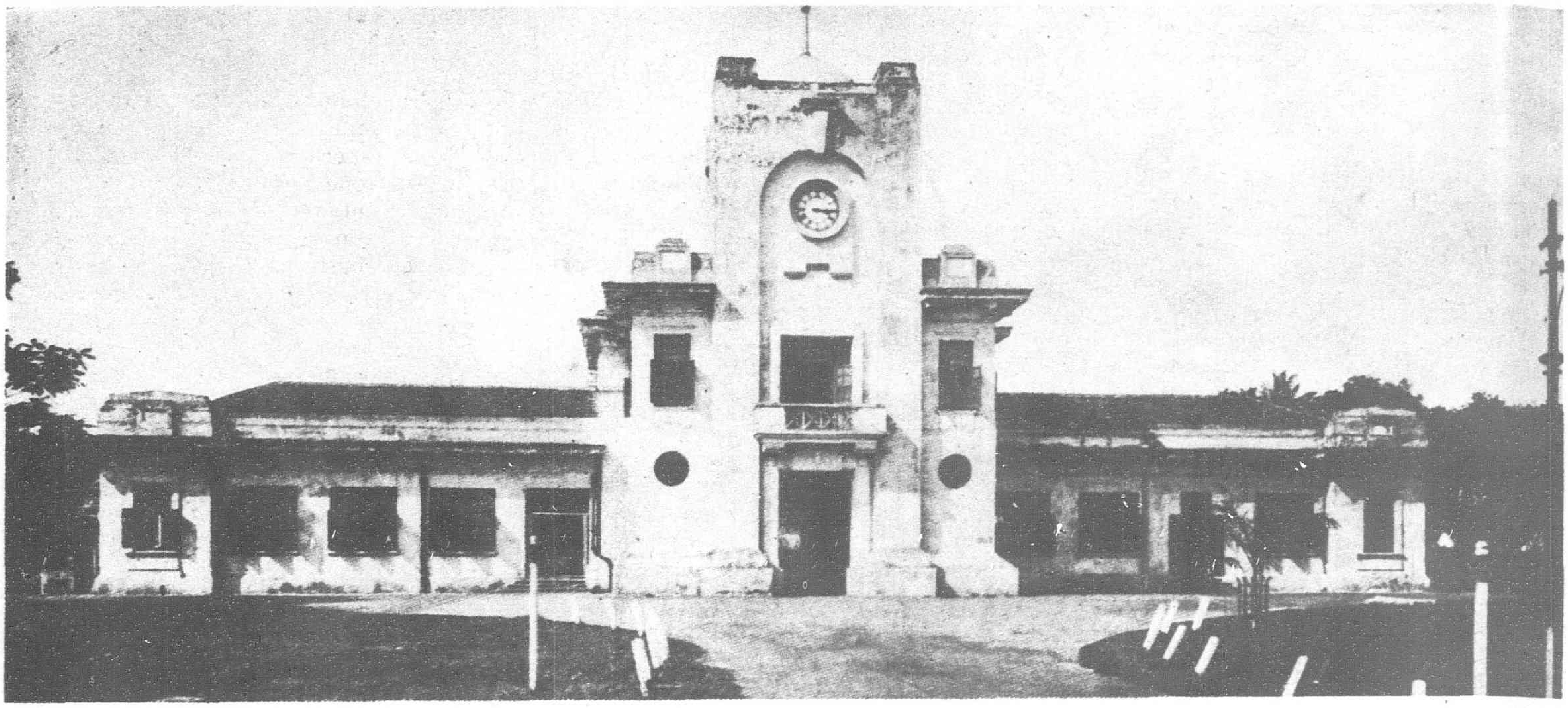
Until the opening of the present building, the Railway Administration had been housed in the building now occupied by the Public Works Department opposite the Chartered Bank. On completion of the new building, the old one was handed over to the Selangor Government.



Singapore Railway Station to-day

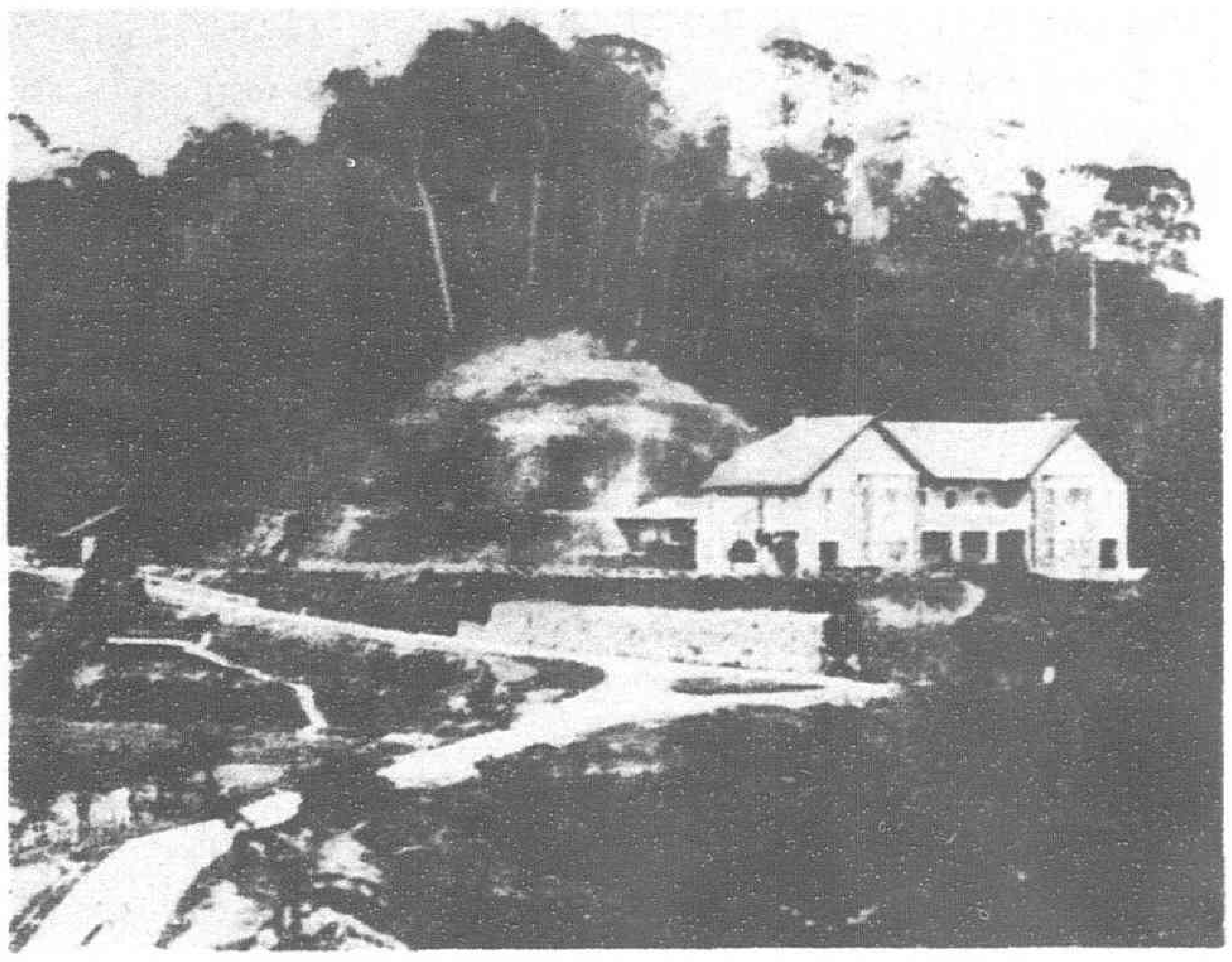
Suleiman House, Kuala Lumpur

This building which is just south of the Railway Station, although now not included in the list of railway buildings, was built by the Railway Department in 1930 as District Offices, the surplus accommodation being let to the Selangor Government to house certain Government Departments. Shortly after the occupation of



Johore Bahru Station

the building, it was decided that the State of Selangor should take over at cost the whole building from the Railway—the latter retaining the use of part of the basement and ground floor to accommodate the Divisional Superintendent's staff. The building, therefore, passed from the Railway to the State, the Railway Department becoming merely a tenant of a comparatively small portion. The name "Suleiman House" is in honor of H.H. The Sultan of Selangor who opened the offices in 1930. The building was designed by the Government architect and built on contract.



Fraser's Hill Sanatorium

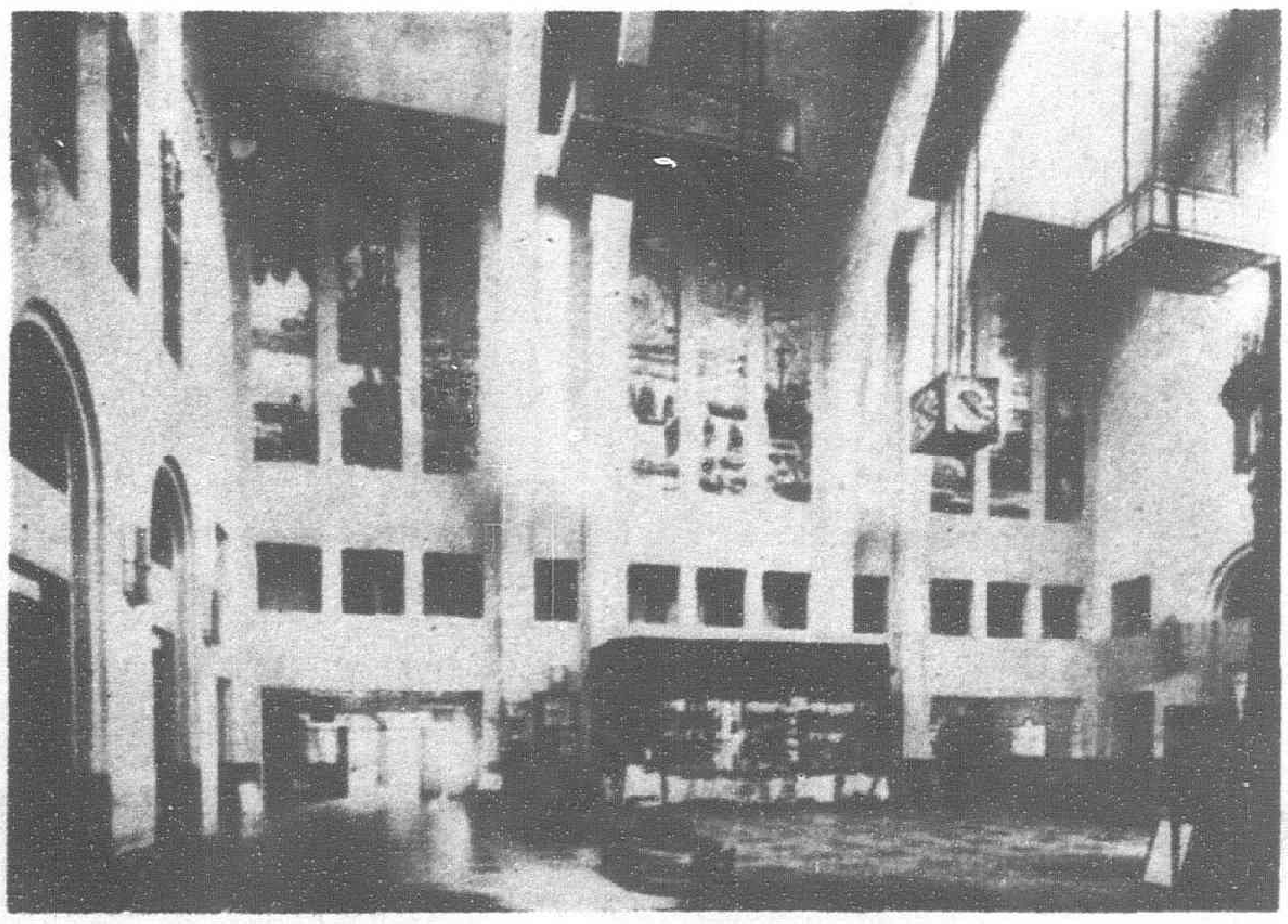
Singapore Railway Station

This was built in 1932 and opened in May of the same year in connection with the deviation of the railway line from Bukit Panjang to Tanjong Pagar.

The original Railway in Singapore built in 1903 long before rail communication had reached Johore Bahru from the north, was purely an island railway running from Woodlands to Pasir Panjang. For many years past no passenger trains were run beyond Tank Road which became the terminal station for all passenger trains. With the taking over of the Singapore Railway by the F.M.S. Railways and the establishment of through traffic to the north by means of the Johore Causeway, the accommodation at Tank Road, in spite of many additions, became very inadequate and after several schemes to improve matters had been considered, it was decided to deviate the line from Bukit Panjang and build a modern station at Tanjong Pagar—the old line being abandoned.

The building is of reinforced concrete founded on "cast in situ" concrete piles. It contains a very fine central waiting hall with a domed roof, the walls being panelled with typical Malayan scenes which are very effective. Surrounding the waiting hall are the waiting rooms, restaurant, bar, etc. There is a separate entrance, booking office and restaurant for third class passengers, thus avoiding any crowding of the first and second class accommodation. The upper floor contains several bedrooms and bath-rooms for the travelling public, which can be occupied at very moderate charges. The center floor of the main building is of rubber, resulting in an absence of noise.

There are two long platforms capable of accommodating the longest mail trains. These are completely covered by "umbrella" reinforced concrete roofs.



Entrance Hall—Singapore Station

Staff Quarters, Singapore

Simultaneously with the building of the new station at Singapore, the erection of staff quarters was carried out. These are situated at the north end of the railway yard bordering Kampong Bahru Road. These quarters differ from the usual railway type in that they are built as flats in three storey structures. The buildings are of reinforced concrete founded on reinforced concrete "cast in situ" piles, and are fitted with modern sanitation, electric light, and water.

Ipoh Station and Hotel

This was completed in 1915. The building was designed by the Government architect and built departmentally. The former station was of medium size similar to the present Taiping Station and the new one was built when general remodelling of the yard, etc., was put in hand. This station is one of the largest on the system. It has three platforms and commodious offices, etc., and the adjoining hotel has seventeen bedrooms, restaurant, bar, etc.

Penang Station

This is a Railway Station without platforms or trains, the actual northern terminus of the railway track being at Prai, connection with Penang being maintained by a ferry service owned by the Railways. The ground floor of the building consists of the usual booking offices and waiting hall and a spacious restaurant, bar, etc. The two upper storeys consist of offices which are leased to the public.

Plans were originally prepared for the building in 1902, but building operations were not commenced until 1905. The foundations consisting of bakau piles gave considerable trouble but were eventually made satisfactory, and the building was completed and opened to traffic in 1908. The building, with its lofty clock-tower, is a conspicuous landmark from the harbor.

Johore Bahru Station

The new station, which was completed in 1931, was erected in connection with the re-modelling of the yard in a slightly different position from the old one. It is a reinforced concrete structure founded on reinforced concrete piles and was designed by the Government architect, Johore. Besides the usual booking offices, etc., rest house accommodation consisting of three bedrooms, restaurant, bar, and lounge is provided on the first floor.

Sanatoria

Port Dickson.—The Railway Department owns two sanatoria at Port Dickson—one for European officials and one for the subordinate staff. The European sanatorium, which was built in 1920, is some five miles south of Port Dickson Town, and occupies a very fine site overlooking the harbor. There are four large bedrooms and dining room, lounge, etc. There is also a hard tennis court, a large and substantial "pagar" on the beach adjoining where excellent bathing can be had. The sanatorium may be used by others than the Railway staff when accommodation is available.

The sanatorium for the subordinate staff is situated on a small hill near the pier. It was originally built for the Superintendent of the old Sungei Ujong Railway (now the Port Dickson Branch) in 1895 and was renovated and re-opened in 1913 as a sanatorium. Later a railway building was provided as an annexe, making the total accommodation four bedrooms, a lounge, and a dining and sitting room. A bathing pagar is also provided.

Fraser's Hill

A sanatorium for European officials was built at Fraser's Hill in 1929. This is situated near the fourth tee and overlooks the golf course. The building is of two storeys and has six bedrooms, two sitting rooms, a lounge, children's playroom and dining room. Others besides railway officials may make use of this bungalow when accommodation is available.

The Story of Japanese Shipbuilding

(Continued from page 295)

for the Nippon Yusen Kaisha, one 7,500 ton steamer for the Dairen Kisen Kaisha, and one 3,300 ton motorship for the Ube Cement Company. Kawasaki shipyards: one 13,500 ton tanker for the Yamashita Kisen Kabushiki Kaisha. Harima shipyards: two 9,100 ton motorships for the Kokusai Kisen Kabushiki Kaisha, and one 7,500 ton steamer for the Dairen Kisen Kaisha. Uraga shipyard: a 4,000 ton cargo steamer for the Setsuyo Kisen Kaisha. Yokohama Dockyard (now Mitsubishi): two 6,500 ton motorships for the Kinkai Yusen Kaisha.

Among the shipping companies who propose to build further tonnage in the near future are the Osaka Shosen Kaisha, the Naigai K.K. Kaisha and the Daido Kaiun K. Kaisha, while it is reported that the N.Y.K. are to build new vessels for their European services and the Kawasaki K.K. Kaisha are contemplating the construction of twelve 16-knot motorships for their New York line. Owing to the difficulty of finding building ways for this tonnage, many Kobe shipowners are calling for a temporary raising of the ban on imports of ships from abroad.

The Shanghai Hong List

All who find it necessary to be well posted on the changes which take place in the business and community life of Shanghai will welcome the appearance, well on time, of the Shanghai Business and Residential Directory, or, as it is perhaps better known, the half-yearly supplement to the China Hong List.

The present edition, which contains close on 600 quarto pages, follows the lines of previous issues in the classification and arrangement of details, the list of hongs, business Who's Who, agents' and trade directories, lists of all streets and a residential directory. A more than cursory examination of the issue indicates that every effort has been made to bring the volume well up to date, a number of last-minute changes being noticeable in the diplomatic, consular, military, educational, and business lists—changes which add greatly to the value of the work.

The trade depression which has rested upon Shanghai for some time is reflected in the disappearance of several old-established firms during the six months under review, while the staffs of several large firms and public utility companies show reductions. On the other hand, a number of smaller firms have come into existence and find a place in the new edition—a work which, judged by all standards, still justifies its claim to the premier position in the field of such publications.

The book is published by Messrs. The North-China Daily News & Herald, Ltd. and is issued at the price of $6.00, or with map of Shanghai at $7.00.

Hongkong Trade Fair

Preparations are being made for a British Empire and China Trade Fair, to be held at Hongkong in December, 1936, or February, 1937. It is designed to bring Chinese and British traders together so that the new conditions governing trade between the two countries may be appreciated.

In connection with the exhibition, which will last one month, a Friends of China Committee is being formed in England. The Earl of Derby is patron, and the members include Lord Sempill, Lord Hirst, Viscount Leverhulme, Sir William Llewellyn, Sir Malcolm Robertson and Sir Francis Goodenough.

A site of 84,000 square feet, adjoining the harbor, has been allotted, rent free, to the organizers of the exhibition by the Hongkong Government, who are also giving a small financial subsidy.

The semi-permanent building to be erected will contain approximately 225 sections. One will be organized by leading Chinese industrialists to show the progress made in modern methods of production in China.

An important feature of the fair will be the Welcome Club, open to all exhibitors and leaders of commerce, both Chinese and British. Private conferences, in a pleasant, sociable atmosphere, it is expected, may solve many of the commercial difficulties at present existing between the two nations.

Delegations of women from various parts of the Empire are being organized. They will meet Chinese women from the principal cities of China, to discuss matters of mutual interest.

It is felt among British residents in Hongkong that the potentialities of the Chinese market at present are not fully appreciated by British manufacturers.

South China, which has for its entrance ports Singapore in the south and Hongkong in the north, is regarded as a particularly fruitful field for British trade.

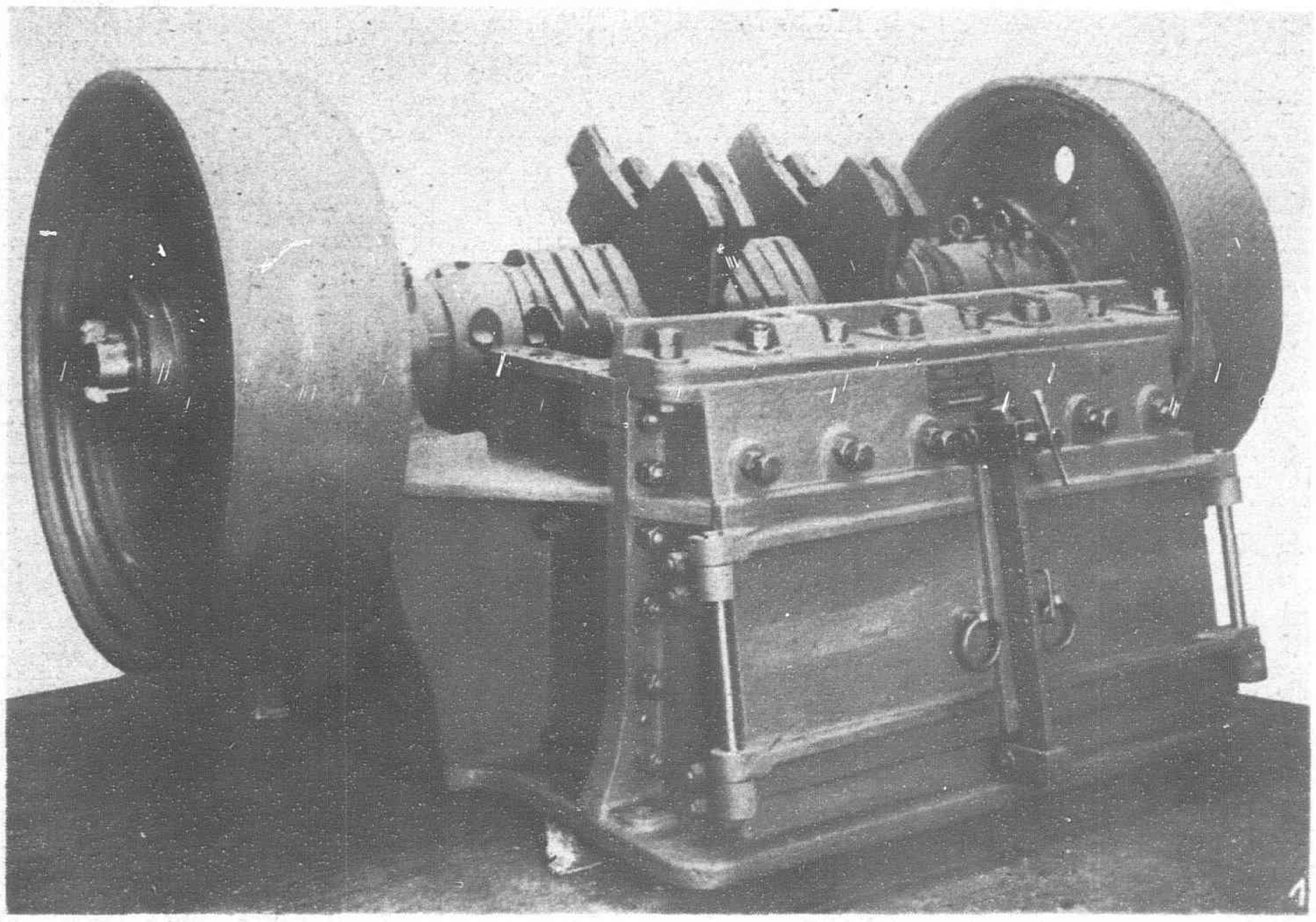
After four years of depression, the annual exports and imports of China are still over £100,000,000. Great Britain's share of the imports is only half of that of the U.S.A.—12 per cent of the total. It is hoped that the Fair will not only increase reciprocal trade, but encourage the greater use of Hongkong as the gateway to a rich market.

Originally planned to be opened earlier the Fair was postponed for a year, owing to serious difficulties as a consequence of the forced rise in the price of silver.

The Fair will, as far as possible, follow the lines of the British Industries Fair, to make Hongkong a show-window for the Empire's products in the Far East.—*Daily Telegraph.*

Hammer Crusher for Plant in the Philippines

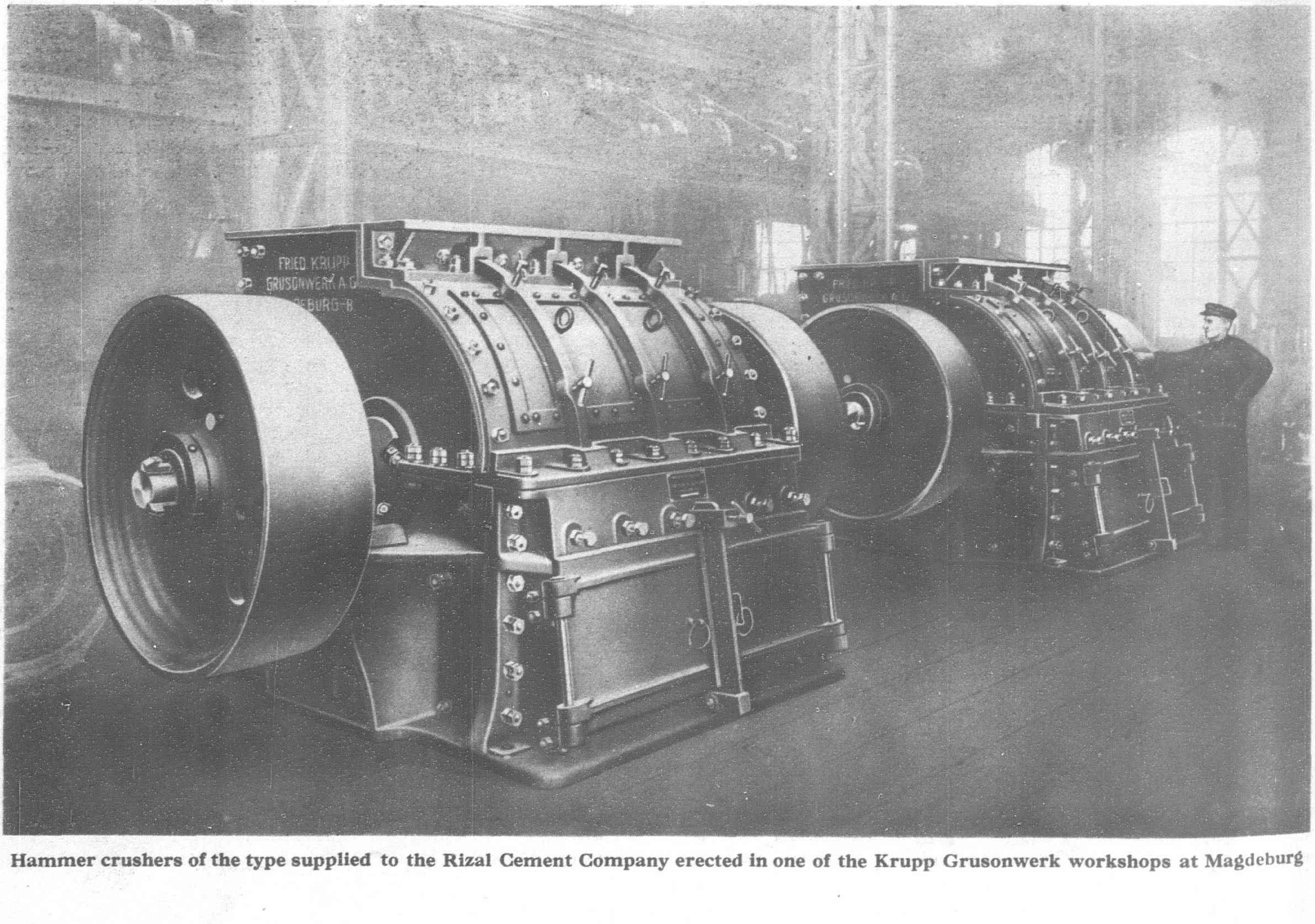
Rizal Cement Company Acquires New Equipment from Krupp Grusonwerk, Magdeburg for First-stage Crushing of Marl and Limestone



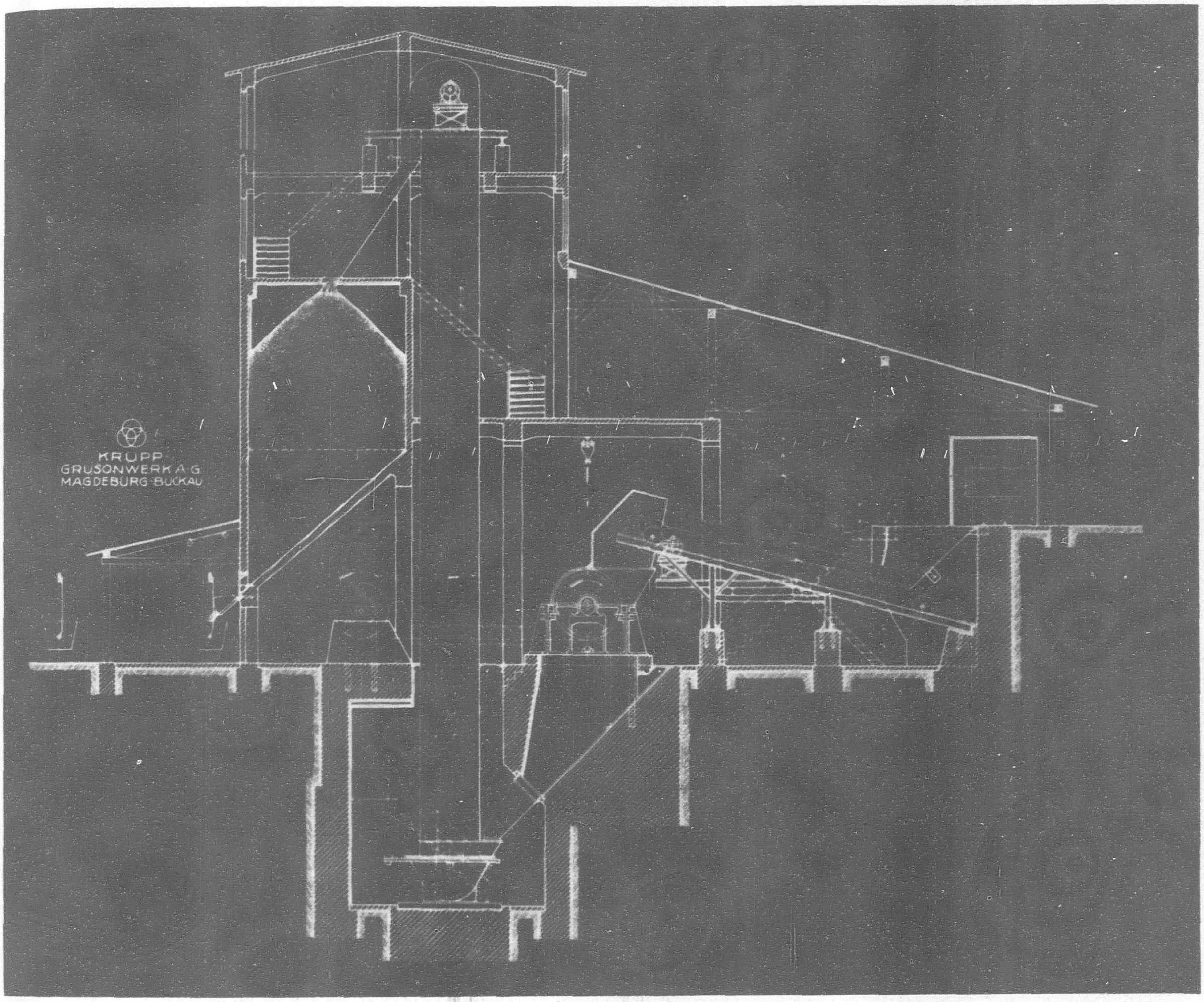
A close-up view of the interior of the hammer crusher showing the arrangement of the beaters

A HUGE hammer crusher of a special type of construction recently has been installed in the plant of the Rizal Cement Company of Manila after having been received from Germany. The big new hammer crusher, which was designed and built by Krupp Grusonwerk at Magdeburg, serves the purpose of first-stage crushing of marl and limestone for the manufacture of cement. It replaces other equipment in the form of jaw crushers and rolls that formerly were employed in the plant to reduce the size of raw material. It is claimed that the installation of the new Hammer Crusher is both less expensive in first cost and, owing to its simplicity of design, was easy to install and is more economical in upkeep, as all parts of the mechanism that are subjected to severe use are easily replaced. In a single passage through the crusher the large pieces of rock in forms as produced in the quarry are broken up into pieces averaging a half inch in size. Power consumption is moderate, as it has been found that this averages only about one and a half horse-power per ton of raw material fed into the mechanism.

The hammer crusher installed in the



Hammer crushers of the type supplied to the Rizal Cement Company erected in one of the Krupp Grusonwerk workshops at Magdeburg



Plan of the plant of the Rizal Cement Company in the Philippines showing new hammer crushers and how raw materials are fed into and discharged from the mechanism

plant of the Rizal Cement Company, which is shown in the accompanying drawing, is 2,000 mm. (about six feet six inches) in diameter and 1,500 mm. (about five feet) wide. It has a capacity enabling it to treat from eighty to 100 tons of raw material per hour and reduce it to pieces an inch in size or less when the material fed into the mechanism is in pieces from 15 to 32 inches in size.

The marl and limestone that is treated is conveyed to the plant in box cars from which the material is tipped on to a plate link conveyor so arranged that it feeds the material uniformly into the crusher. As it leaves the machine this pre-crushed material drops into a bucket elevator and is delivered into a bunker provided with outlets which discharge into the trolleys of a cable way that convey the material to a fine-crushing plant. A Krupp crude oil engine furnishes the power for driving the hammer crusher.

Hammer crushers of the type supplied by Krupp Grusonwerk to the Rizal Cement Company are provided with a single beater shaft and are constructed for capacities up to 400 tons per hour. The output, of course depends on the fineness of the product required and on the condition and hardness of the materials treated. One of the accompanying illustrations shows hammer crushers of this type in one of the Krupp Grusonwerk workshops and another gives a close-up view of the interior of the crusher showing the arrangement of the beaters. These revolve within a casing made of cast steel or steel plate. A strong grate is located in the feed opening and another grate is arranged in the lower part of the casing. This consists of triangular bars and discharges the crushed materials that are reduced to required sizes, but retains all pieces that are not sufficiently reduced for further disintegration by the beaters.

China and Marine Wireless

Following European practice, with a few exceptions all seagoing steamers in Chinese waters of more than 1,600 tons are now required to install wireless apparatus under regulations recently adopted by the Legislative Yuan. Vessels which are exempted include passenger steamers plying not more than twenty nautical miles from the shore and those with a route between coastal ports not exceeding 200 nautical miles; freighters of less than 1,600 tons which do not ply beyond 150 nautical miles from shore; and junks and vessels of simple structure not intended for deep-sea navigation. The Chinese Government intends to exercise strict supervision over wireless installations on ships, and no wireless station may be operated until a licence, renewable every five years, has been granted by the Ministry. One of the regulations requires all wireless operators on ships to be Chinese citizens, holding certificates of competence issued by the Chinese Ministry of Communications.

The Frontier Between Manchoukuo and Outer Mongolia

AN EXPLANATION

By CHARLES BISHOP KINNEY

JUNE 22, 1936

THE task of drawing a map, showing the exact demarcation line between Manchoukuo and Outer Mongolia is to-day impossible as the frontier separating these two States, has never been properly surveyed and marked.

After looking over dozens of available maps, published by Chinese, Japanese, Soviet, Manchoukuo, American, and British sources, I knew that my task would be most difficult, as none of the maps showed a similar demarcation line and to make matters worse, names of villages or important drinking wells, would be found in some maps located in Outer Mongolia and in others the same places would be situated in Manchoukuo. Maps obtained from Soviet sources (mainly from the economic bureau of the former Chinese Eastern Railway) disagreed as to the frontier and location of place names.

This can also be said of maps from Japanese sources, especially the numerous maps published by various journals. Chinese maps were useful mainly to detect location of places, while maps from British and American sources contained nothing which I could use. In fact the meager information of place names along the Manchoukuo-Outer Mongolian frontier gave me the inspiration of making a map which would perhaps be useful to observers of the Far Eastern situation, especially those interested in the Manchoukuo-Outer Mongolian phase. *This map is naturally unofficial*, and may serve its purpose until an official map is charted, but this cannot be realized until Manchoukuo and Outer Mongolia form a commission to undertake the task of properly defining and marking the frontier.

Another point must be explained. In spelling the place names mentioned on the map I had the same difficult task as in the marking of the frontier. To prove this, let me quote a paragraph written by an American journalist, stationed in Manchoukuo, and published in *Oriental Affairs* a Shanghai magazine :—

> "It is not strange that some misunderstandings arise in connections with place names in north-west Manchuria. In a recent statement from the Manchoukuo Foreign Office, regarding an affair on the Outer-Mongolian border, the Foreign Minister gave the name as "Jaminhottok," which the Outer-Mongolians, for some unknown reason, call "Ulan-hotoku." It would be useless for a foreigner to consult his atlas or maps in search of either of these words. Mongolian place names find their way into Roman letters over three different paths. Chinese early recorded the Mongol sounds in their characters which unfortunately lack final consonants. When the Chinese characters are romanized the resultant spelling has not always been uniform. Russians transcribed the Mongolian with their alphabet and these renderings have also been reduced to English letters. Since Japanese pronunciation of the Chinese characters bore little resemblance to the original Mongol sounds, they marked their maps in Kana. The romanization of the Kana gave another spelling. Great is the resulting confusion. It is nearly as difficult to locate the places named in the reports of the border clashes, as it seems to be for the opposing frontier guards to agree on the location of the line. The debated area seems shockingly backward—obviously an unattractive location and a most unsuitable place to hold a really modern war."

I have not attempted to give the various spelling of place names ; in Outer Mongolia I have used the Soviet pronunciation of Mongolian names and in Manchoukuo I have used the Manchoukuo pronunciation of Chinese or Mongolian place names.

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REFERENCE

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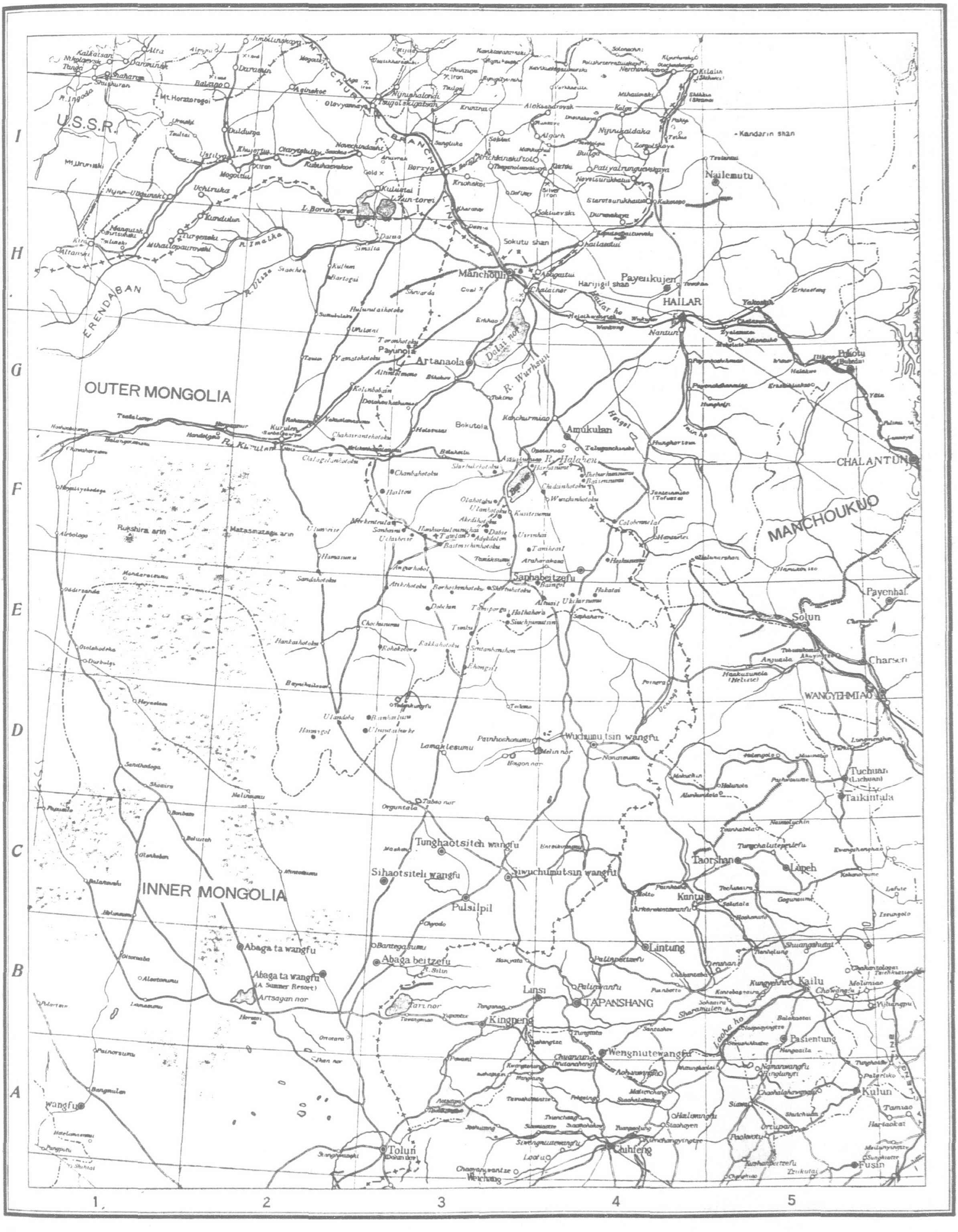
┼┼┼┼┼┼┼┼ Palisades
═══════ Roads

Unofficial Map of the Manchoukuo-Outer Mongolian Frontier 1936



BTH Equipment for the "Queen Mary"

Seven Turbo-Generators Supplied for the Auxiliary Services

THE seven turbo-generators for supplying the whole of the electricity for the auxiliary services on the *Queen Mary* were supplied by the British Thomson-Houston Co., Ltd.

Each of these turbo-generators has a normal rating of 1,300 kw. 225-volts, with an overload capacity of 25 per cent for two hours and 50 per cent for five minutes. The combined normal capacity is therefore, 9,100 kw., which is sufficient for the needs of a moderate sized town. Each set comprises a BTH 10-stage turbine driving a D.C. generator through reduction gearing, the speed of the turbine being 5,000 r.p.m. and the speed of the generator 600 r.p.m. The sets are of the combined turbine and condenser type in which the condenser is integral with the turbine, thus enabling the whole unit to be on the one floor level. The whole of the sets comprising turbines, generators, gears and condensers were manufactured in the BTH Rugby Works.

Four of the sets are designated " Main machinery sets " and three " Hotel service sets." The main machinery sets are for supplying power to the numerous motor driven auxiliaries, such as pumps for water, lubricating and fuel oil, bilge and ballast, etc. They operate on steam at 370 lb. per sq. in. gauge pressure, 680 deg. F. total temperature.

The hotel service sets are for supplying the numerous electrical services installed for the comfort of both passengers and crew. Among these services may be mentioned heating, cooking, ventilation, lifts, pumps for sanitary service, swimming baths, etc., as well as the very heavy lighting load on a ship of this enormous size.

These latter sets are required in port as well as at sea, and since the boilers for supplying steam to the main propelling turbines are shut down when the vessel is in port, these sets operate off auxiliary boilers supplying steam at the turbine stop valve at 230 lb. per sq. in. gauge pressure, 650 deg. F. total temperature. Steam is bled from these turbines for feed heating purposes.

It will be noted that by the adoption of such high pressures and temperatures marine practice is now following that on land.

For emergency purposes there are installed on the vessel two BTH 75 kw. D.C. generators driven by Parson Oil engines.

A considerable number of electric motors of BTH manufacture are used for auxiliary drives, the machines ranging in size from ¼ to 20 h.p. Amongst the larger BTH motors are twenty-four each of 20 h.p. for driving the life-boat winches, the controllers for these machines also being supplied by the BTH Company.

Lighting Equipment

In addition to the plant already described, the British Thomson-Houston Company, Ltd., has played an important part in the supply of lighting equipment.

Many hundreds of special lighting fittings of novel and unique construction, designed by BTH Engineers, are employed throughout the ship, while the world famous Mazda Lamps, another BTH product, are used in their thousands and in variety of types.

Special equipment, comprising " Mazdalux Three " projectors and 1,000 watt lamps, has been provided for the flood-lighting of the three giant funnels and upper structures. This feature will be most spectacular and will add greatly to the impressiveness of the giant liner and her graceful lines.

The Cabin Class Main Hall—Promenade Deck, provides the main circulating center for the cabin class section of the boat, and can be likened to a miniature Regent Street. In common with the lighting schemes throughout the ship, special attention was given to the immediate surroundings, such as furnishings, decoration and architectural features when designing the special fittings.

A magnificent fitting was manufactured and installed as the central feature in the main hall. This fitting is five feet in diameter and comprises three tiers of heavily moulded decorative glass, weighing nearly half a ton, and employing 44—40 watt pearl lamps.

The general illumination is provided by 262 feet of indirect cornice strip employing 524—15 watt pearl lamps. A number of fittings three feet in diameter similar in construction to the main fitting, are also employed and are situated at the entrances to the writing rooms.

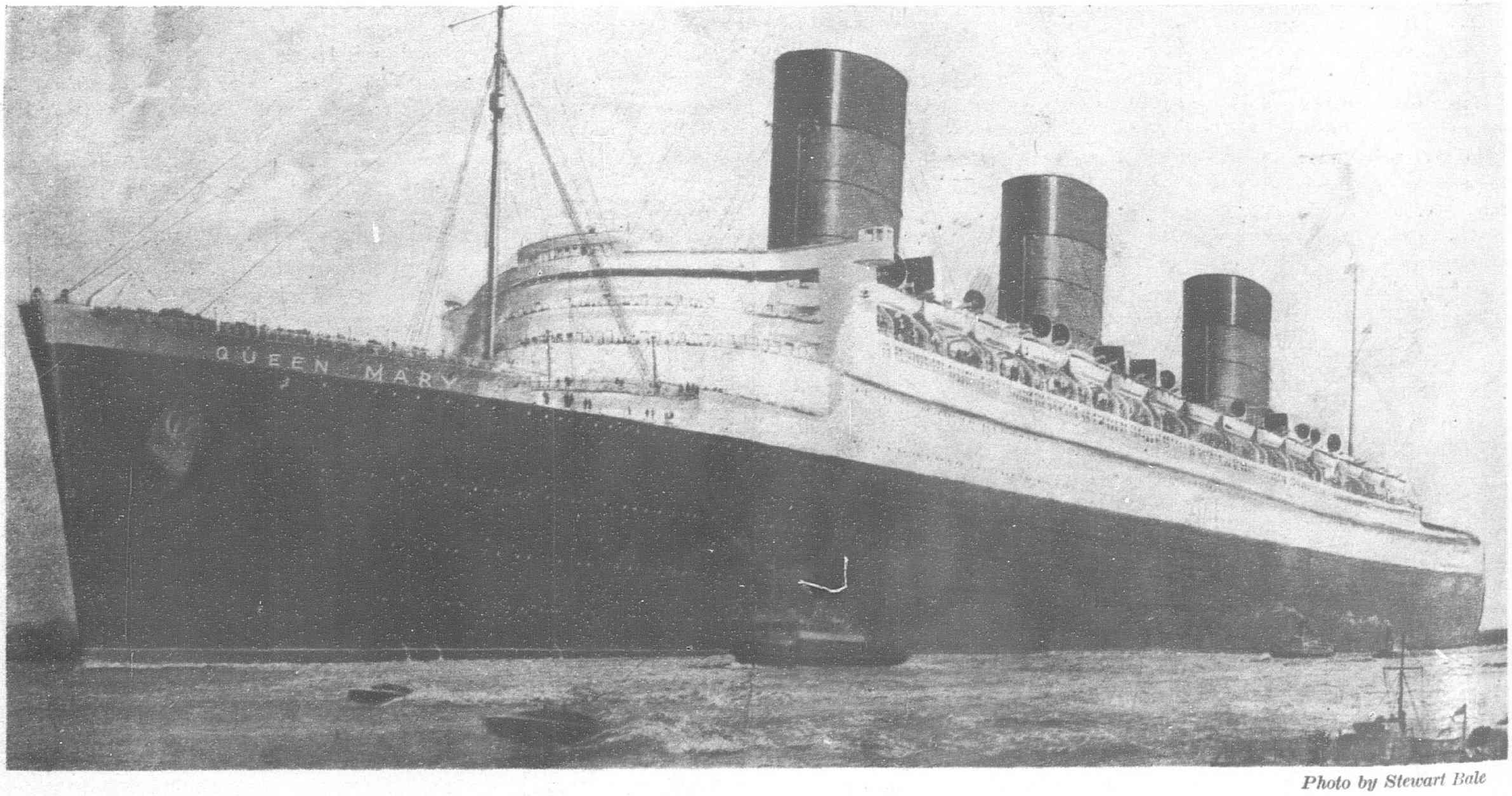


Photo by Stewart Bale

An impressive view of the " Queen Mary "—Official photograph supplied by Cunard White Star Ltd., Liverpool

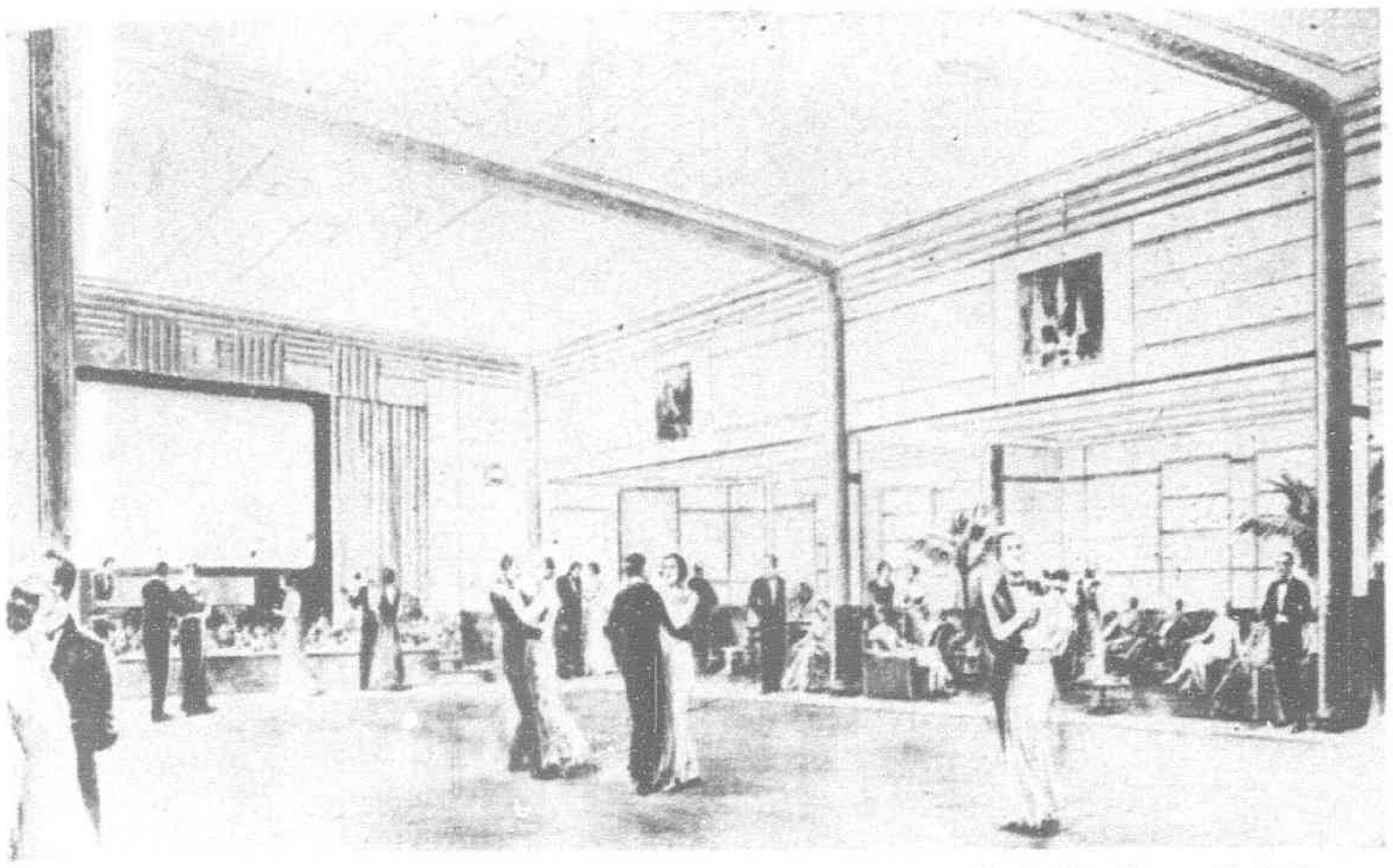


Photo by Stewart Bale

Artist's impression of the tourists' lounge, main deck

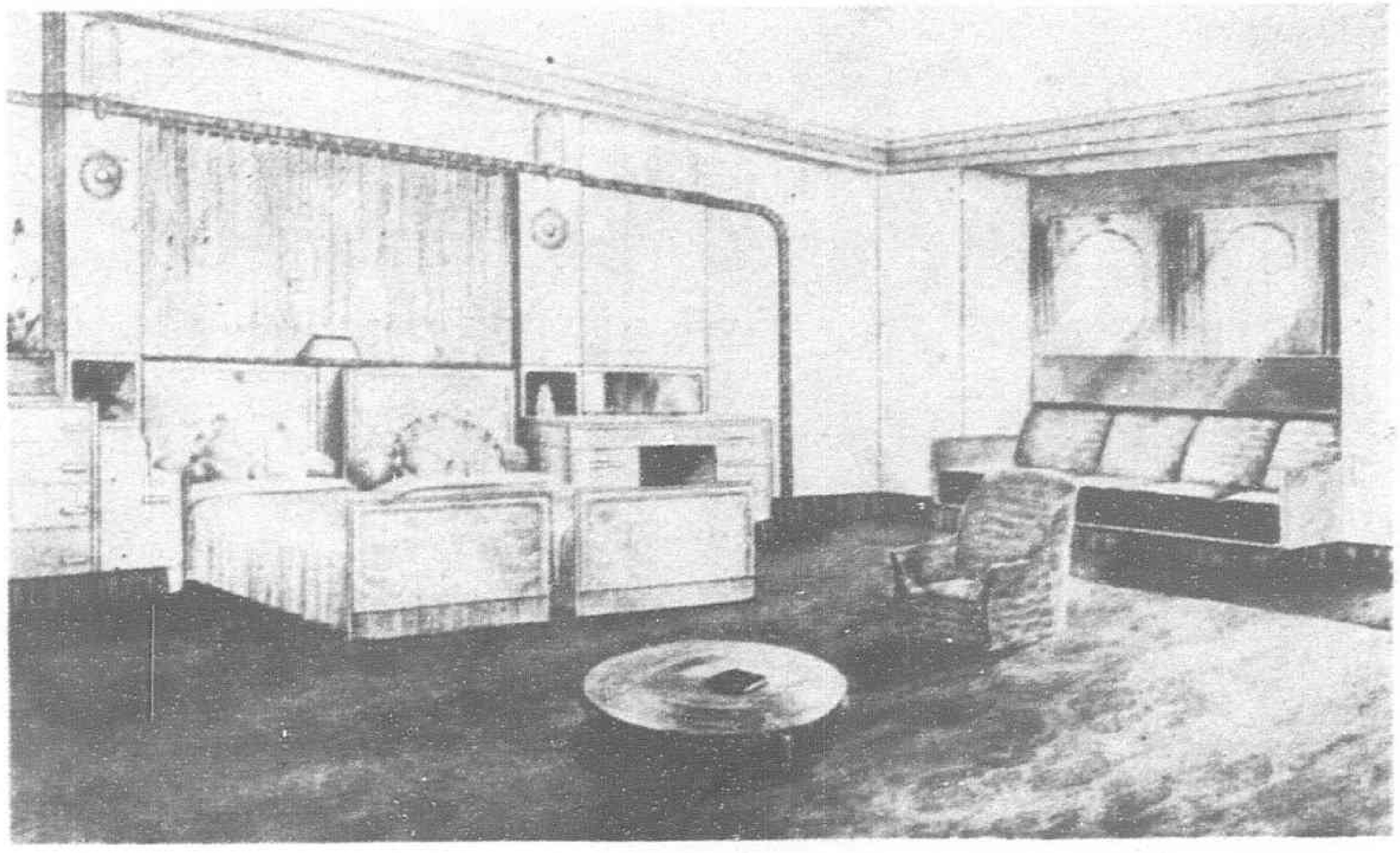


Photo by Stewart Bale

Artist's impression of one of the staterooms

In connection with the extensive ventilation system a special fitting was designed to harmonize with the remainder of the fittings and form an attractive pattern on the ceiling; each of these fittings employs one 200 watt lamp. BTH Lighting fittings also provide the lighting of the various shops in this area.

One fitting of noteworthy and unusual character is the luminous parrot cage supplied for the children's playroom. It is situated over a sentry box and is essentially a decorative feature. The parrot, constructed of fire-proof silk, is a hand painted representation of a West African parakeet, and is illuminated from within by two small lamps. The case of the cage forms an illuminated panel and gives a soft downward diffused light.

In the Verandah Grill Restaurant—an exclusive dining room—the BTH Company has supplied a unique fitting which is considered to be one of the finest on the ship. It is constructed of various colored sections of half-inch plate glass and is circular in shape with a diameter of 3-ft. 9-in. The plate glass sections bear a heavy etched design which is in keeping with the mural decorations of the room. In the center of this room there is a small dancing floor which is surrounded by a decorative glass balustrade illuminating the dance floor; 156—15w blue, red and green sign lamps are installed in this balustrade. The main white lighting is provided by built-in indirect cornices employing 296—15 watt lamps and colored lighting with 264—15 watt colored lamps. This lighting is controlled by the BTH Thyratron Valve Reactor Dimmer, described later.

The BTH Company has also supplied the lighting fittings for the Cabin class writing, dining, lecture, music and drawing rooms; the library, "A," "B," "C" and main deck entrances, main and aft staircases, promenade deck and entrance, sun deck entrance and the tourist deck shops. A novel soffitt fitting provides illumination for the aft staircase. One fitting is extensively used in main alleys and passages all over the vessel. This fitting employs one 60 watt lamp.

The phrase "Beauty Enriched by Light" might well be applied to the world's fastest and most graceful liner.

Thyratron Reactor Control of Lighting

BTH Thyratron Reactor control has been chosen for the color circuits of two of the elaborate lighting installations of the *Queen Mary*. By means of this system, the lighting may be controlled to give an infinite number of tints and colors, a novel feature being that its color and volume can be automatically varied in harmony with the music. In effect, the lights and music may be "played" as one—the tone of the light literally being regulated by the tone and pitch of the music. In view of its novelty the installation is described in detail.

Essential Features of the Thyratron-Reactor Dimmer.—Instead of the usual variable resistance elements in series with the lamp circuits, variable reactance is used. This necessitates an A.C. supply being provided for the system.

The main components of the BTH Thyratron Reactor Dimmer for each lamp circuit to be controlled, are as follows:—

(1) An iron cored reactor.

(2) The Thyratron circuit.

(3) A small variable voltage device which controls the Thyratron, and can be remote from the main power circuits. Standard incandescent lamps are used with the equipment.

This form of dimmer has been made possible by the development of the Thyratron, a type of grid controlled rectifier, the D.C. output of which can be varied by a controlling voltage of very low power, applied to its control electrode, or grid.

Thus the variable voltage device (item 3 above), applies voltage of adjustable magnitude to the Thyratron. The latter has its anode circuit connected directly to the A.C. supply from which it takes power to supply direct current to one winding of the saturable reactor.

The saturable reactor consists of a laminated iron core of special four-leg construction, carrying two windings, one, the A.C. winding, being in series with the lamp load to be controlled, while the other is supplied with D.C. from the Thyratron.

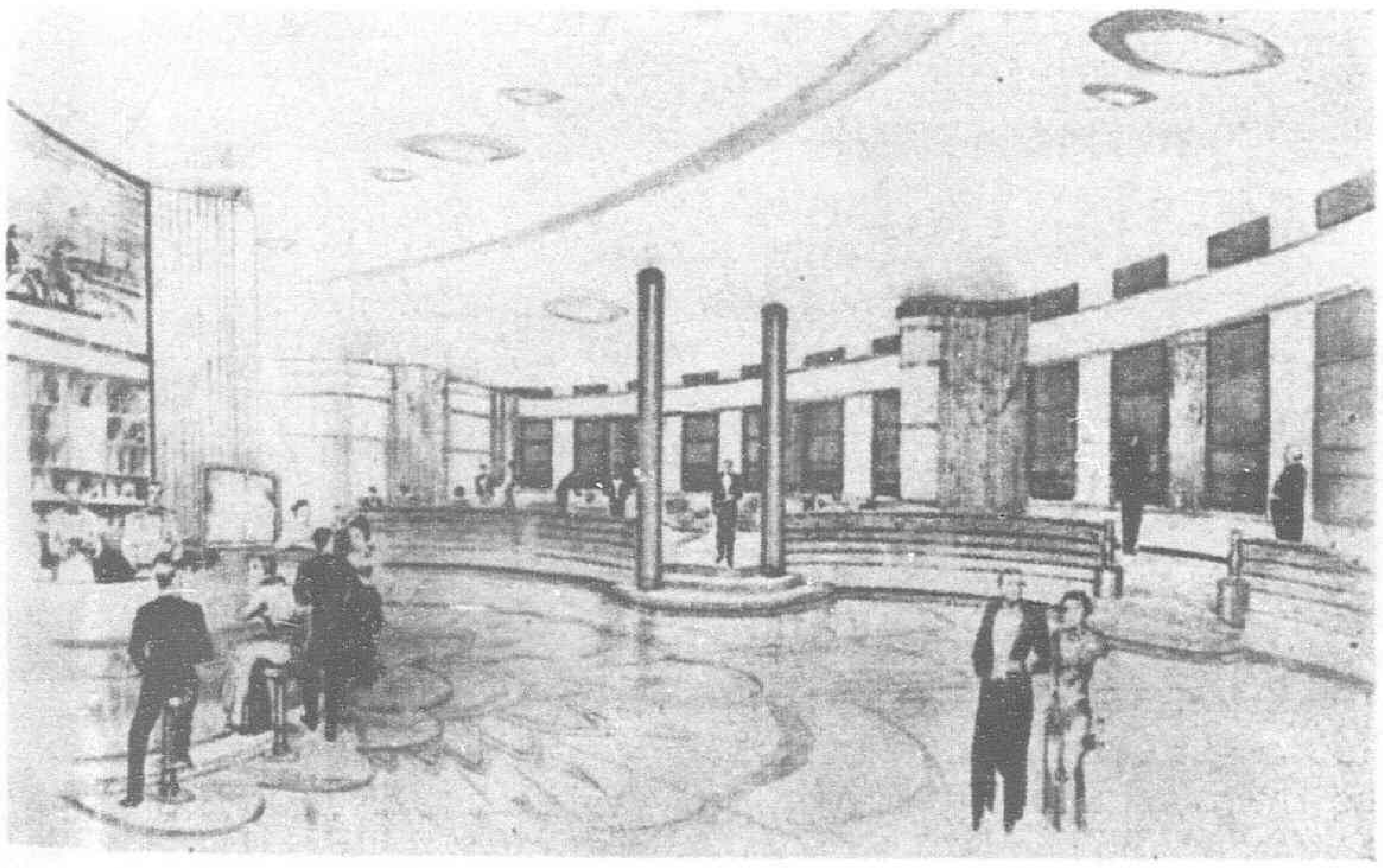


Photo by Stewart Bale

Artist's impression of observation lounge and cocktail bar

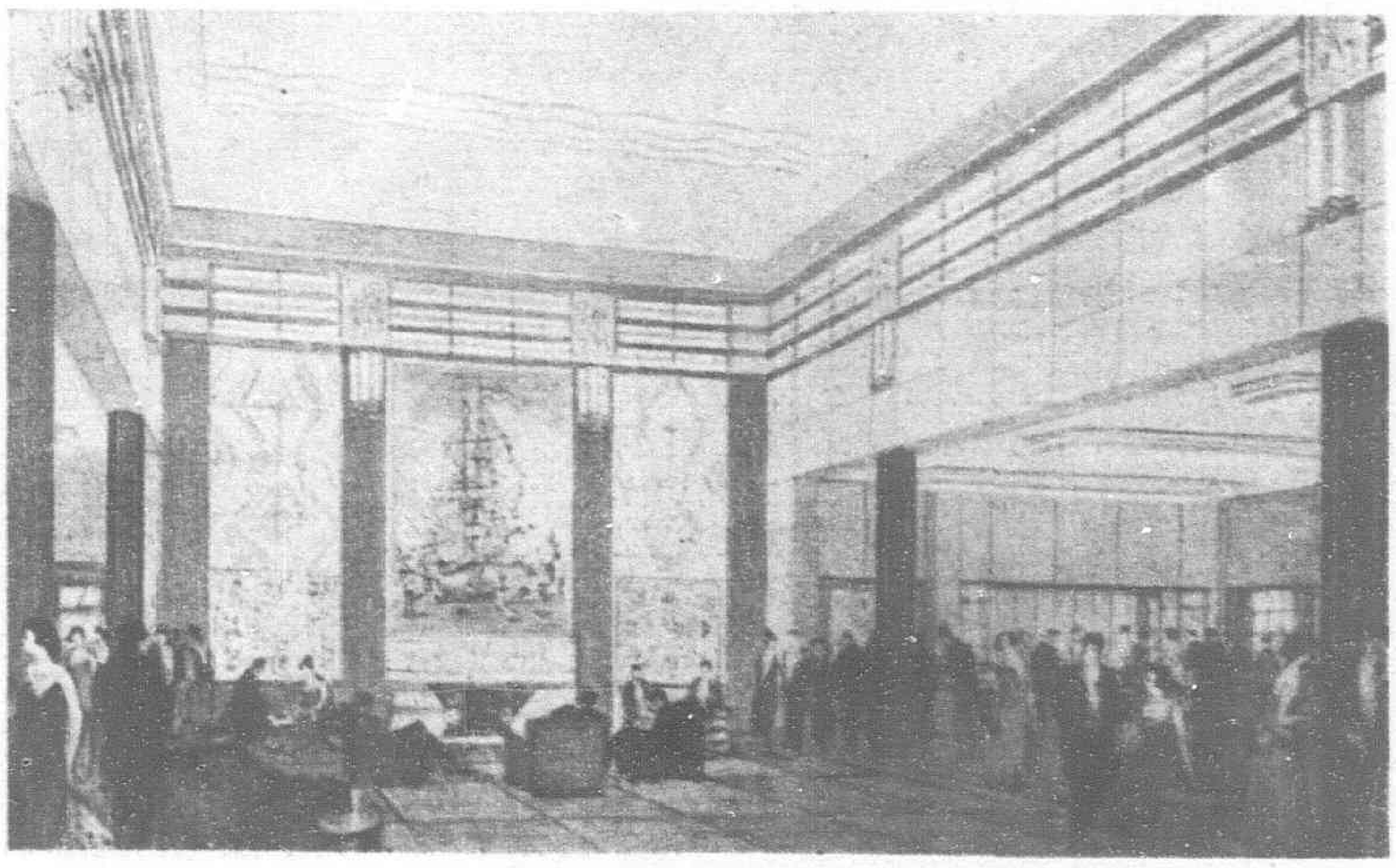


Photo by Stewart Bale

Artist's impression of smoking room, promenade deck

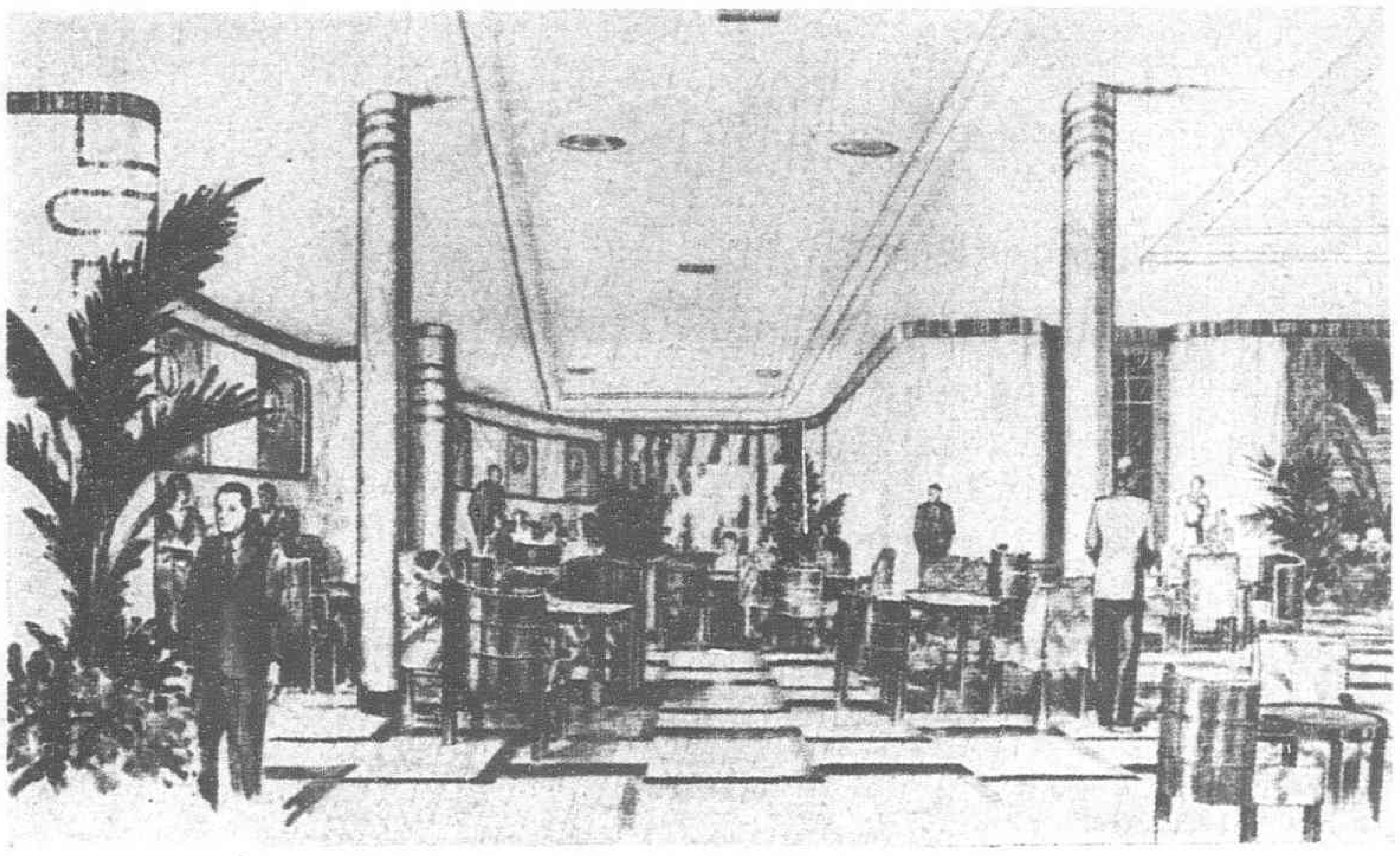


Photo by Stewart Bale

Artist's impression of a section of the third class winter garden

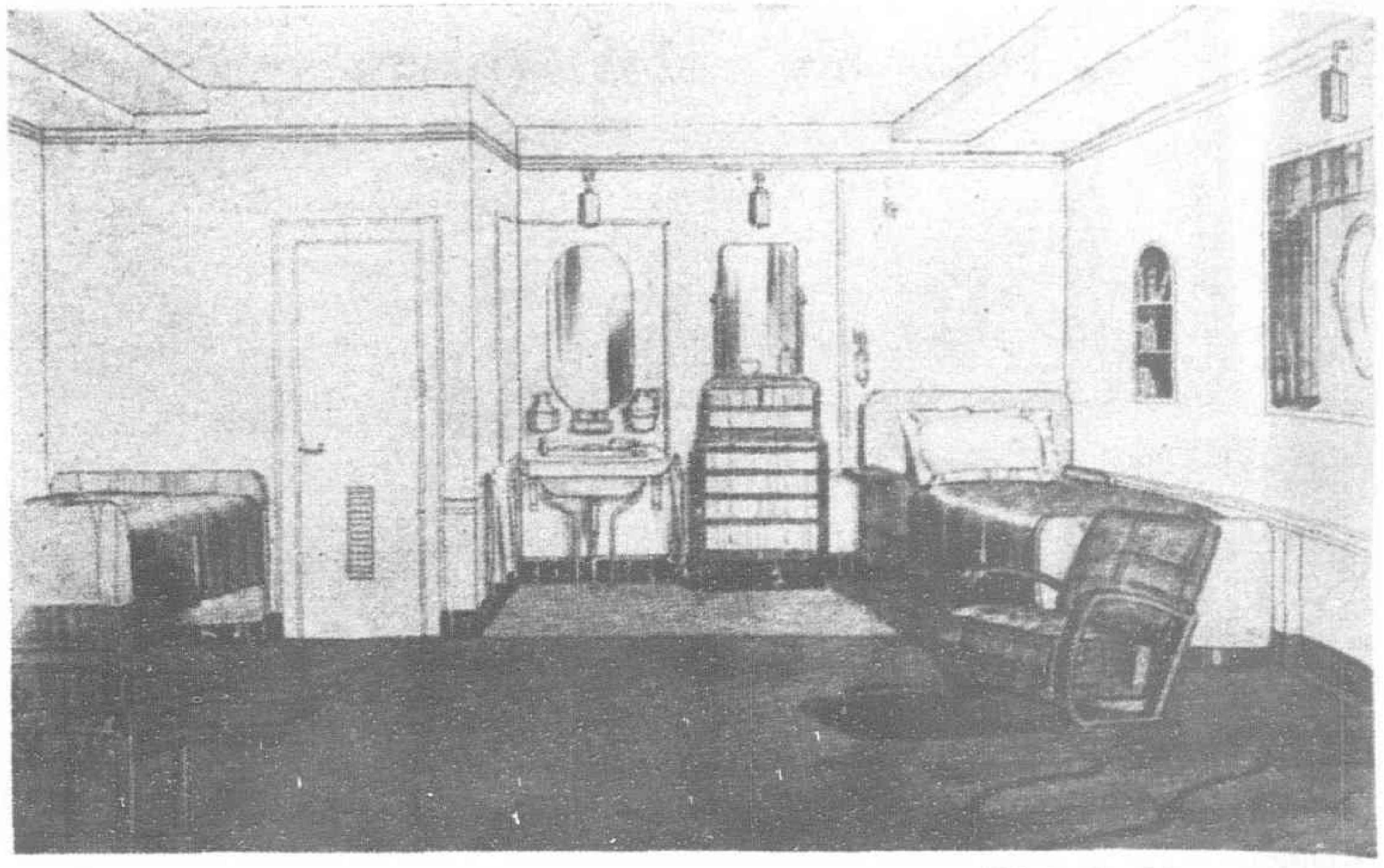


Photo by Stewart Bale

Artist's impression of tourists' stateroom

When a small controlling voltage is supplied to the Thyratron, the rectified output of the Thyratron is likewise small. This results in a small D.C. flux in the iron core of the saturable reactor, the A.C. winding therefore having a high reactance. The lamps are thus dimmed to a low intensity. An increased voltage supplied to the Thyratron increases the D.C. output of the latter, and also therefore, the D.C. flux saturation in the reactor core. The reduced permeability of the iron results in a lower value of reactance, and hence an increase in lamp current.

Operation of the remote control member, delivering less than one watt, thus controls the brilliance of a large number of lamps, representing, if desired, a very large kw. load.

The Ballroom and Verandah Grill Lighting Circuits.—The ballroom and verandah grill are equipped with Thyratron Reactor control for the colored lighting circuits. Except for the kw. capacity, the equipment for each room is identical, and comprises control for three banks of colored lamps, namely red, blue and green. The master control board is located near the lamps it controls so that the operator can observe the effect produced. The Thyratron-reactor equipment is located on a lower deck. The iron cored reactors are mounted in shelves immediately behind the Thyratron panels, which control the circuits of one room. It will be noted that unit construction is employed both for the intensity control devices and the Thyratron apparatus. The Thyratron panels are capable of controlling any lamp circuit up to about 16 kw. Thus the only variation between circuits of different capacity is the size of the saturable reactor.

The master control board provides for three independent forms of control as follows :—

(1) *Manual Control.*—This is used primarily for " setting up " any predetermined intensity on each of the three banks, to give the desired color mixture. Master control is provided by the knob on the extreme left, and any or all of the circuits can be operated simultaneously.

Mention may be made here of " proportional dimming," which is achieved only by Thyratron Control. Let us assume that a certain desired color combination is achieved with the circuit intensity levers set, for instance, at 10, 8 and 6 (10 being full-bright). When this combination is brought up from blackout, by means of the master, correct proportionality is maintained. Similarly, on fading to blackout, proportionality is maintained during the fade out. With a resistance dimmer the desired combination only occurs when the master is at full bright.

It will be noted that although the Thyratron dimmer is remote controlled, the dimming speed is under the control of the operator.

(2) *Cyclic Control.*—On depressing the appropriate push button, the three colored banks are brought under cyclic control, i.e. the colors rise and fall continuously, in cyclic order, to give an ever changing array of color combinations.

A small adjustable-speed motor operates on three variable voltage devices which supply the Thyratron grid circuits. By varying the motor speed through the medium of the speed control rheostat on the reactor rack the rate of change of the color combinations can be varied by about four to one.

(3) " *Sound* " *Control.*—This form of operation is novel, and can only be achieved by Thyratron-reactor control. Depression of the " sound " push-button on the master board brings into operation an amplifier, the output of which feeds into the Thyratron grid circuits. Microphones are installed in the first class ballroom and in the verandah grill, providing an audio-frequency input to the respective amplifiers. Amplifier output is fed to an electrical filter, which divides the output into three channels, according to frequency. Each of these channels provides the controlling voltage for a Thyratron circuit and thus operates one bank of colored lights. By this means a low frequency note picked up by the microphone operates one color, a middle frequency a second color, and a high frequency note brings in the third color. The amplitude of the sound determines the intensity of illumination of the lamp banks. The system thus gives a color mixing system, automatically controlled by the orchestra, the lighting rising and falling with combinations in sympathy with the music.

The electric cookers made by Messrs. Henry Wilson, Ltd. are heated by Torribar heating elements made at the Rugby Works of the BTH Company.

Japan to Build Airports

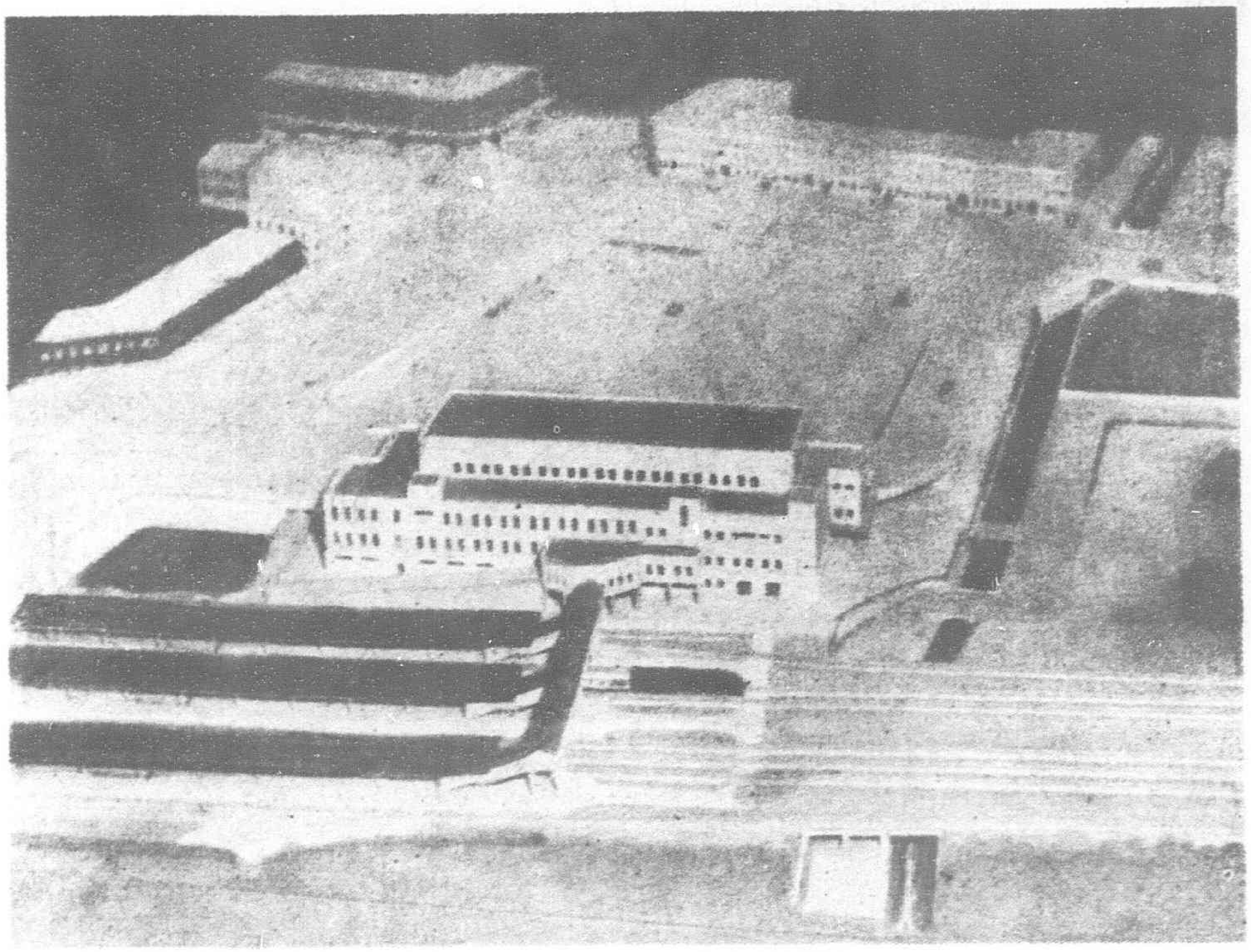
Surveys made by Japanese prefectural governments at the request of the Imperial Aviation Association have located more than 800 suitable sites for airports in all parts of the country, the *Asahi* said recently. Of these 300 will be selected for development with subsidies to be provided by the association.

Under the slogan "provide our cities and villages with airports," the association has been conducting a nation-wide campaign for the development of commercial aviation which has already resulted in the construction of 13 airports by private interests in the Hokkaido, the main island and Kyushu. Several others have been built with funds provided by cities, towns and villages.

The commercial air line to the Hokkaido and Saghalien is expected to be put in operation during the next fiscal year, the *Jiji* reported. It will connect Tokyo with Toyohara, Saghalien, by way of Sapporo, Asahikawa and Horonai in the Hokkaido. The aviation bureau of the Communications Ministry has been drafting a 10-year plan for the development of commercial flying that will cost Y.200,000,000, the *Jiji* said, and it is expected that an initial appropriation will be included in next year's budget.

Airports already constructed by private initiative are the Chitose in the Hokkaido, the Shinonomehara in Akita Prefecture, the Ohanasawa and the Yawatahara in Yamagata Prefecture, the Shibane in Gumma Prefecture, the Chuetsu in Niigata Prefecture, the Suwa and Matsumoto in Nagano Prefecture, the Yamanashi in Yamanashi Prefecture, the Ryosanryu in Tottori Prefecture, the Miyagi in Kumamoto Prefecture, the Miyakonojo in Miyazaki Prefecture and the Shikaya in Kagoshima Prefecture.

New Railway Station for Port of Dairen is Being Completed



New Railway Station at Dairen as it will appear when all work has been completed within the coming two years

THE lofty and far-reaching steel framework of the new S.M.R. station at Shinano-cho in the city, recently reared, vividly indicates the imposing dimensions of the Y.1,500,000 structure, to be ready for occupancy early next year. The deep and spacious basement of the building, into which all arriving passenger trains will enter from next year, is substantially complete already.

The subway space is greater than the huge building itself, which is 100 meters broad, 50 meters deep and 25 meters high, according to an official of the Takaoka Building Contractors, a Dairen firm erecting the structure.

"We have at present 20 Japanese technicians and foremen and about 450 Manchu workmen on the job," he declared. "But we shall have twice as many men when the outer walls and the roof have been completed. Our company, that built the Dairen main post office near the Nihon-bashi and other big structures in the city, started on this job late in August last year. We finished the foundation work and walling of the subway before the winter set in. Since we have been rushing the erection of the steel girders, forming the framework for this station building. The ferro-concrete pillars, bracing the steel girders, are nearly complete.

"*All materials for the big structure are products of Manchuria* and Japan. All the granite blocks out there came from Hsiungyaocheng, and those steel bars, angles and girders from several steel plants in Japan. All steam-heating equipment has been ordered from the Osaka Electric Company. All bricks, cement and most of the timber used here are Manchurian products.

Basic Price Y.800,000

"The basic contract price on the original S.M.R. specifications for the station was close to Y.800,000, but several amendments have been made on the original plans since our company's tender was accepted. So the contract agreement has been slightly altered since.

"The main changes in the specifications were all designed to promote greater convenience for passengers and facilitate further train operations in the subway and on the main floor. All departing trains will leave from the ground floor, while arriving trains roll into the subway, where their passengers will alight.

"Our company's work will be finished by the end of the year, when interior decorators and furniture people will get busy in the building. So I believe the station will be formally opened for public use some time next spring.

"When fully completed the station itself will have cost the S.M.R. over Y.1,500,000 altogether.

"Besides, all that space in front of the station building, as far as Sakae-machi will be cleared of the existing buildings and converted into a broad circle, with motor ways, promenades, lawns, shrubbery and a fountain. The work of razing the many unsightly structures up there will start sometime in the coming summer.

Costly Building

"Including the purchase price of the tract for the projected circle and the station premises, the whole of this undertaking is expected to cost nearly Y.3,000,000. So it is probably the costliest building enterprise in Dairen's history.

"Local prices of building materials have not fallen since last year, contrary to popular belief, and our company is paying those Manchu workmen practically the same scale of wages as in 1935 or 1934. Like other builders here, we have been delayed in getting started on this construction work this year, due to the lingering winter, and to the delay in the arrival of certain materials from Japan.

"Although the station structure will have only three storeys, it actually has the height of five ordinary storeys. The ceiling for all the floors in the new station will be quite high. High windows, a roof garden, Manchurian motifs in decorative schemes and a broad promenade will be other distinct features. The walls along the first storey will be lined with Hsiungyaocheng granite, and the upper walls will be tiled.

"The S.M.R. has designed the building to be the largest and most stately station along its entire line, a building worthy of Dairen, the gateway to Manchuria. And our company is striving to execute the contract loyally, and materialize that worthy aim."

Asked regarding the relative expenses of putting up such a big structure in a city in Japan and in Dairen, the Takaoka firm executive stated that it is slightly lower in Dairen than in Tokyo or Osaka. The difference was due partly to the need of incorporating "anti-earthquake" features (extra steel braces, struts, thicker walls, etc.) for all large structures in Japan, he said, and partly also to the lower wages of manual workers here. But he emphasized that the difference in cost is not so great, as popularly imagined, because the average local building worker is less efficient, requiring greater labor unit for a given piece of work, than among the experienced toilers in Nippon.

British Plant for Japan

A contract for two high-pressure boilers for Kansai Kyodo, Amagasaki, Japan, recently has been secured by Messrs. Babcock & Wilcox, Ltd. The boilers are of single pass sectional water-tube type with parallel flow, self-draining, double multi-loop superheaters, and Bailey water-cooled furnace walls. The furnace is completely water-cooled by Bailey blocks comprising the front wall, two side walls, rear wall, and hopper bottom, and the units are made complete by the installation of two flash-welded economizers, tubular air heaters, soot blowers, and all standard accessories.

The boilers are equipped for pulverized fuel firing with Babcock-Fuller Lehigh mills, each boiler being equipped with three such mills, each capable of grinding 12 tons of coal per hour, together with Babcock-Lodi burners.

The size of each unit is worthy of note as these boilers are the largest so far ordered in the Far East. The evaporating capacity of each is 440,000 lb. of water per hour at a working pressure of 582 lb. to the sq. in., generating steam with a final temperature of 867 degrees Fahrenheit.

Singapore Base Nears Completion

Seven-Year £30,000,000 Fortress Protecting British Commerce is Part of Vast Fortified Triangle

SINGAPORE—gateway to the Far East, guardian of the wealthiest trade route the world has ever known—is the steel hand in the velvet glove of Britain's diplomacy in the hemisphere it guards.

A seven-year program, involving about £30,000,000, ends in a few weeks' time. It has converted Singapore from a weakly defended center of international trade into one of the most powerful naval bases in the world.

This program was started seven years ago, when a mammoth floating dry dock, 855 feet long and 178 feet wide—big enough to lift a 50,000 ton battleship right out of the water—arrived at Singapore.

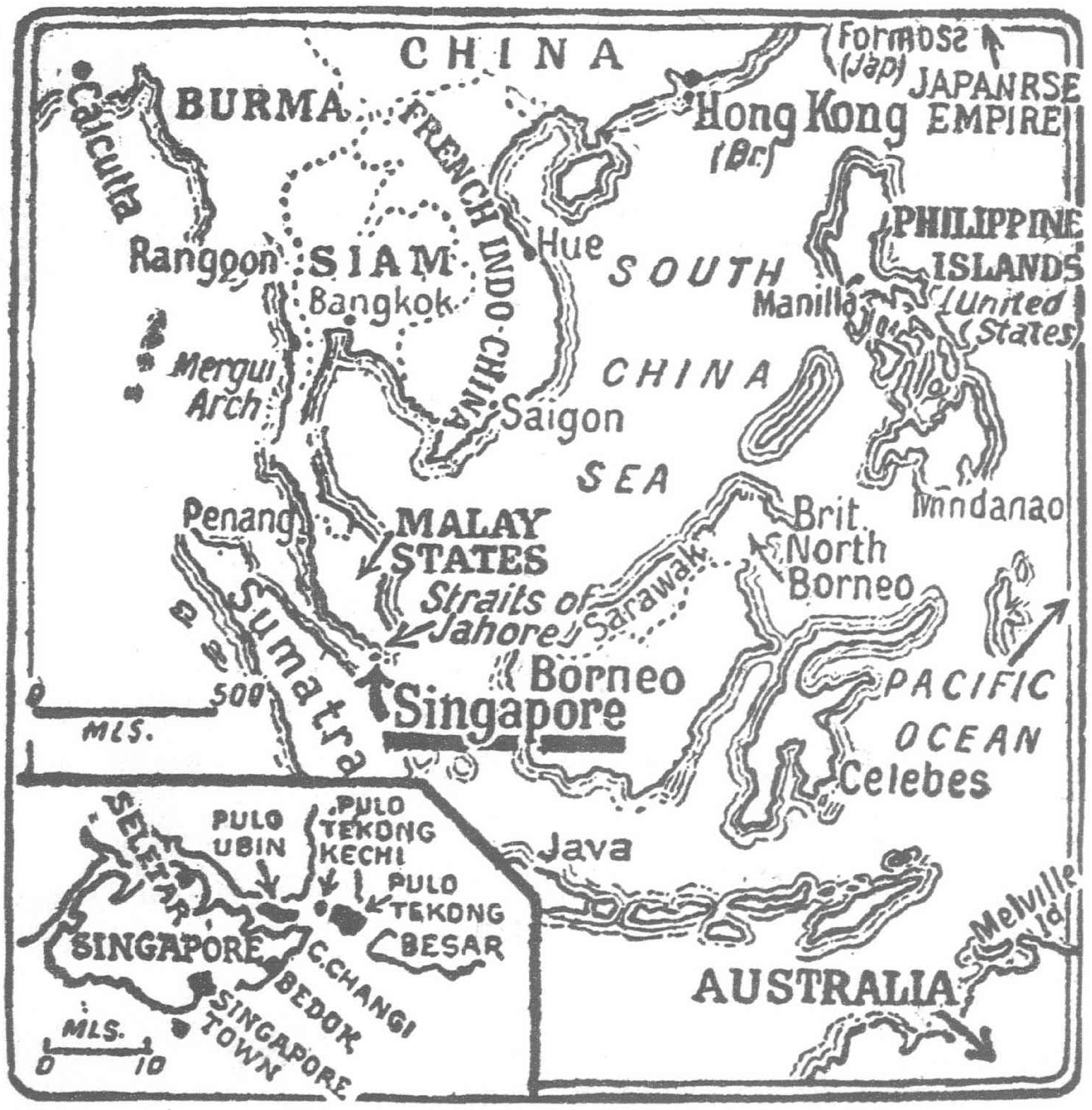
More than 60,000 men can stand on its submersible deck; and it took eight Dutch tugs three months to tow it east from Wallsend-on-Tyne.

Its official name is Dock IX. Dock VIII, which is slightly larger, is at Malta, Britain's naval base in the Mediterranean.

Malta needs fortified Gibraltar to back it up, but Singapore, in its seven-year-plan, has combined the functions of both and established the security of Britain in the East for many generations to come.

Dock IX was moored off Seletar, which, carrying out the comparison with the Isle of Wight, is Singapore's Ryde.

Near by, 2,800 acres—more than four square miles—of land have been cleared for two of the best equipped naval and air bases in the world; writes the Foreign Editor of the *Sunday Express*. The navy yard has store and fuelling wharves, a 2,200-foot quay a 935-foot graving dock, a power plant, caissons, pumps, a 150 ton crane, machine and plate shops.



The Singapore fortified area, showing its relation to the trade routes of the Far East

Jungle Now Fortified

The 600 acres of military and naval air-field, once primeval jungle, have steel hangars, workshops, barracks, and a broad concrete ramp for seaplanes.

South of these, is a greater wireless station which enables the Commander-in-Chief to talk each day with the Admiralty in London. He can talk, too, with Ricamond, near Sydney, and with Darwin, in North Australia; both of these are air bases of the future.

At Changi—Singapore's Bembridge—a village has been converted into a garrison town with artillery, engineer, and infantry barracks. The hills are fortified with anti-aircraft and long-range batteries.

Changi and the rest of Singapore can shell the district round the island within a radius of twenty miles—enough to prevent any enemy squadron passing through the narrow navigable channel.

Singapore is the seventh largest port in the world. Through it passes—and must pass—all traffic between East and West.

The trade of the route that leads through the Suez Canal, past Aden, past India, to the Malay Archipelago, where it can turn north to China and Japan, south to Australia and New Zealand, is one of the greatest routes in the world.

On it, everyday in the year, steams $200,000,000 worth of British ships and cargoes.

In the Archipelago these ships sail through an international zone in which, before the rise of Singapore, they were unprotected and exposed.

Maze of Dangerous Reefs

The Archipelago is a vast region of dangerous channels, a maze of islands and treacherous reefs. It has one main navigable channel, and commanding that channel is Singapore.

Nearly 7,000 ships call at Singapore each year, bringing a king's ransom in trade. From the Malay Archipelago comes nearly all the world's rubber. The peninsula and some of the Dutch islands have the greatest tin mines on earth.

On the islands of Sumatra, Java and Borneo is oil.

The Malay Peninsula, controlled by Britain, juts out into the Archipelago, and is a part of it. Its gross international business in a good year is £230,000,000: in a lean year is little less than £113,000,000, and the balance of trade is nearly always in Malaya's favor.

The biggest item on the list is rubber. In 1934 Malaya exported two-thirds of the world's rubber—677,000 tons out of her total exports of 1,017,000 tons.

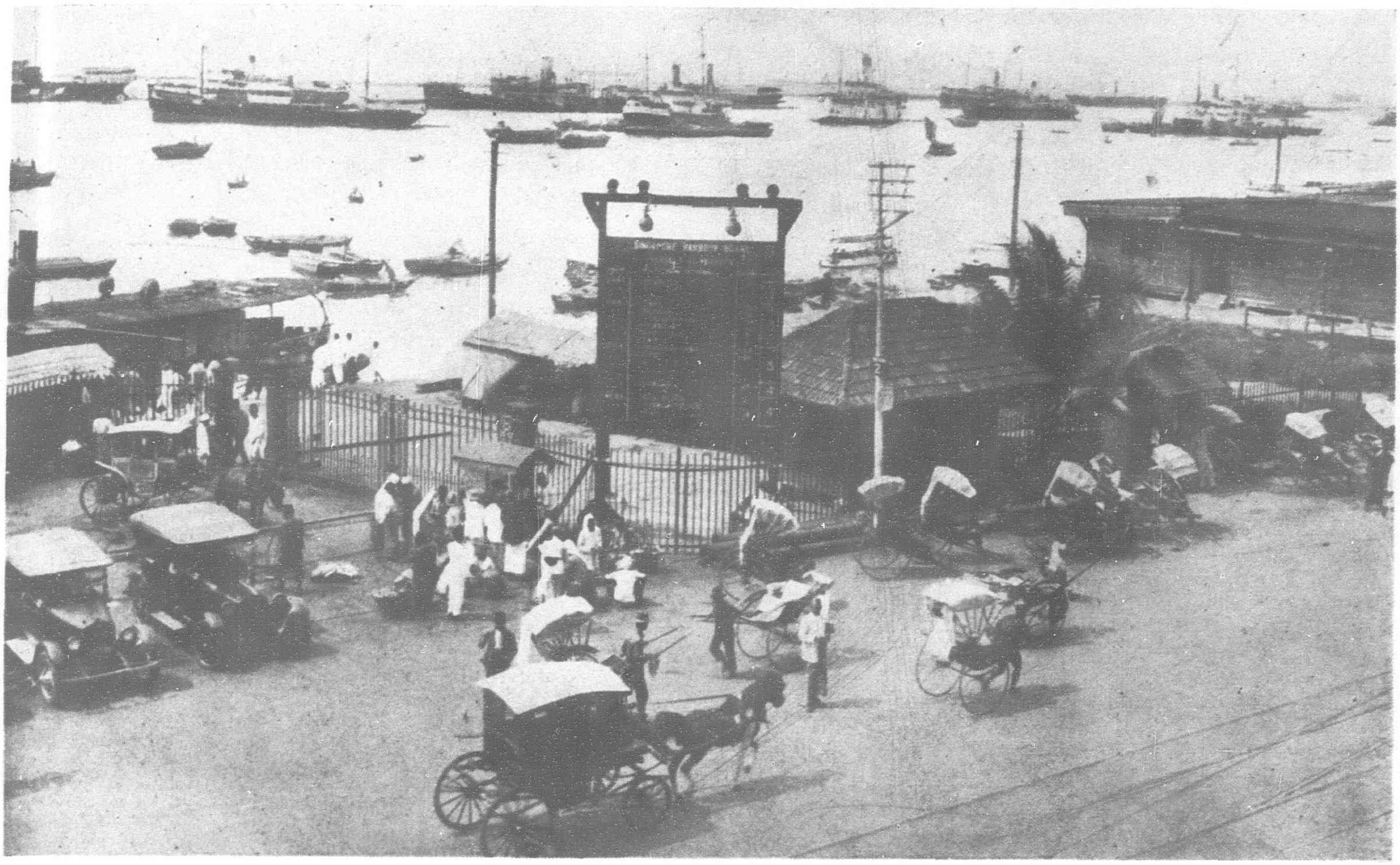
In the same year Malaya exported 60 per cent of the world's tin.

In 1934, also, Malaya exported £5,100,000 worth of petroleum products, although no oil is to be found in Malaya. It came to her from Dutch Borneo, from Sarawak, a British protectorate in Borneo, and from Sumatra.

And it came to Malaya because at the tip of the peninsula there is an island, at whose southern base is the port of Singapore, which, little more than a hundred years ago, was the dream of an Englishman called Raffles.

Stamford Raffles was an extraordinary young man. He left school at fourteen and went to work as an extra-clerk at India House. At thirty, he was chosen by Lord Minto, Governor-General of India, as his chief civil adviser in his expedition to Java.

And when, on its conquest and annexation in the same year—1811—Minto returned to Calcutta, he left Raffles as

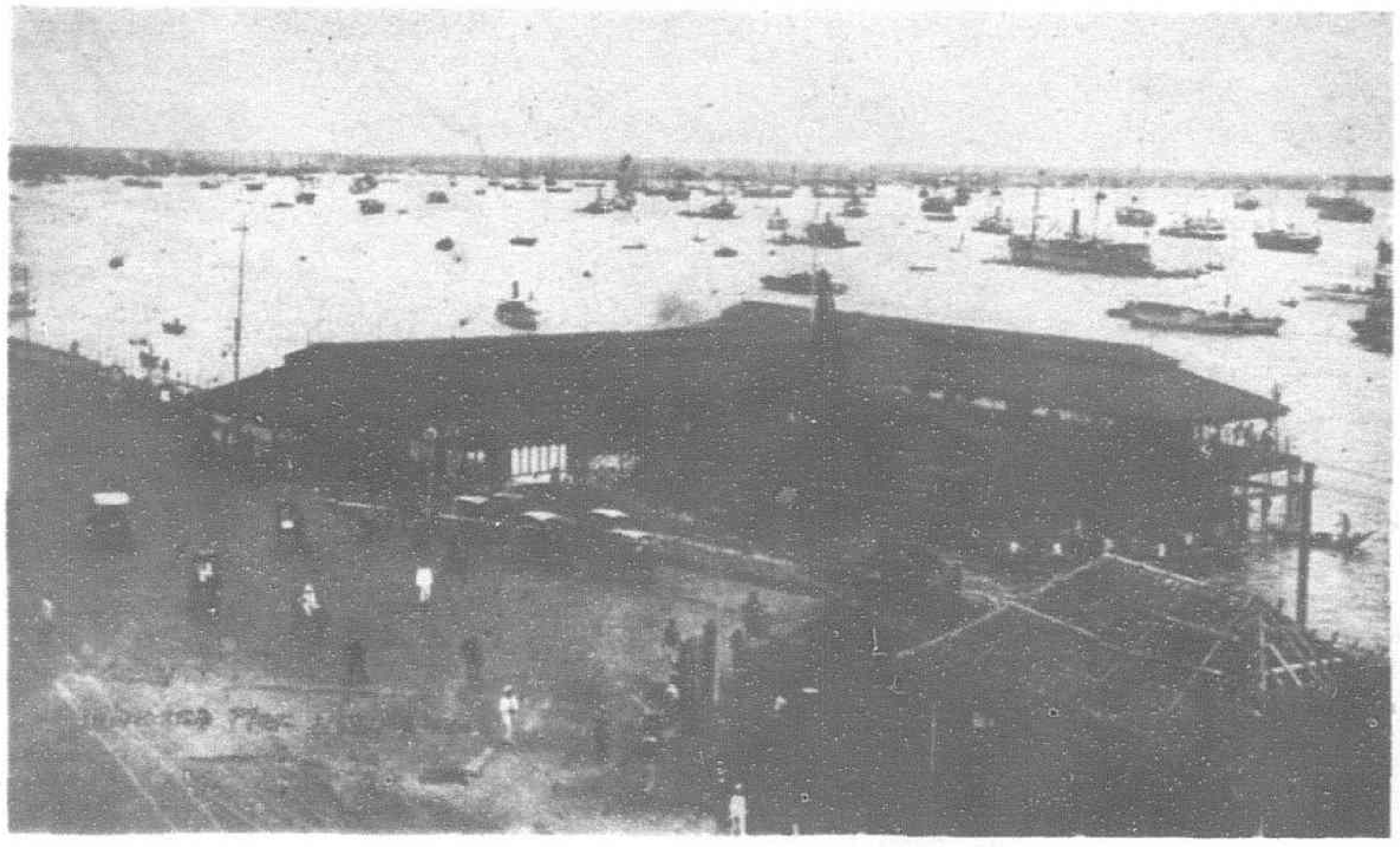


Singapore harbor as seen from the American Consulate

Lieutenant-Governor in charge of the island and its 5,000,000 inhabitants.

But, with priceless stupidity, the British Government, under Castlereagh and Canning, traded, sold and gave away all that we possessed there. They returned their conquests to the Dutch, and when Raffles protested he was snubbed.

In 1818 the tide turned in his favor. Lord Hastings, Minto's successor, impressed by Raffles' insistent warnings that the Dutch would rise to pre-eminence over the British in the East, sent Raffles in search of a foothold in the area which the Dutch were intent on sealing up.



Johnston pier, Singapore

Key to Wealth of the East

A few weeks later, worried by the vacillating home Government, Hastings changed his mind and wrote to call him back.

But Raffles had gone off like a bullet from a gun, and before Hastings penned his recall Raffles had planted the Union Jack at Singapore with his own hands.

Singapore grew. Here more than 400,000 people, of whom only 7,600 are Europeans, have

Malay street, Singapore

High street, Singapore

reared a colony which has become the key to the wealth of the East.

Last year Singapore exported goods valued at £66,300,000 and imported £55,000,000 worth—and most of that paid commissions to merchants.

The need for a strong base in the Middle-East was officially recognized at the Imperial Conference in 1921. Australia and New Zealand aggressively informed the conference that the war and the Panama Canal had shifted the world's stage from the Mediterranean and the Atlantic to the Pacific.

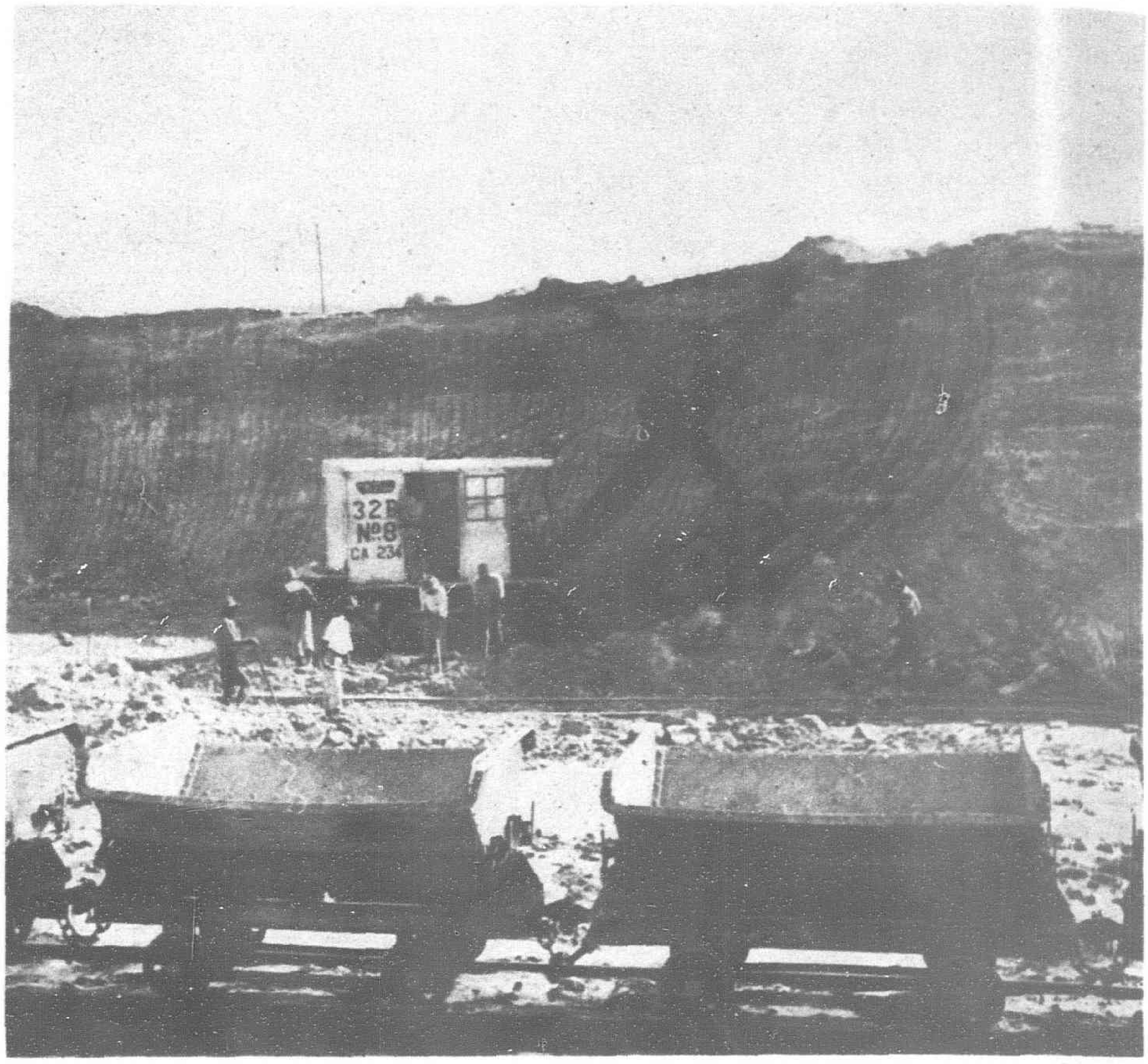
Premier W. F. Massey, of New Zealand, tried to put the problem tactfully.

" Supposing Japan had been on the other side during the war," he said. " I do not mean to say that this is possible . . . . . but . . . . one result would have been certain. Neither Australia nor New Zealand would have been able to send troops to the front."

This sealed the argument. At the Washington Naval Conference in 1922, between Britain, United States and Japan, Britain abandoned the Anglo-Japan treaty for mutual defence in the Pacific, and insisted upon an adequate base at Singapore, where a fleet could put up for repair and fuel.

In 1924 Colonel Sir Maurice Hankey, the one permanent Cabinet official and one of the most powerful men connected with it, stopped at Singapore on his unofficial world tour.

He returned to London and said, in effect, that a naval base was hopeless unless the existing fortifications were strengthened to withstand a first-class naval attack—presumably by Japan or America.



Showing one of the big Ruston-Bucyrus excavators at work providing earth filling for the Singapore aerodrome four miles away

This was the birth of the seven-year-plan which ends this year. Even this is to be carried further, to link Singapore, Darwin (Australia), and Hongkong into one great fortified triangle.

On Singapore will hinge a modern defence system combining sea and air.

All this is very acceptable to Holland, America, and France, whose interests in the East are protected by Singapore. But to Japan the plan is far from acceptable.

During the war, Japan started her textile industry on a competitive war that revolutionized the trading system of the world.

The Japanese not only made their goods more cheaply, employed cheap labor, used more efficient machinery, but they sold their goods direct without having to pay fat commissions to such people as the merchants of Singapore.

Another view of a Ruston-Bucyrus Dredger Excavating earth for the Singapore civil aerodrome

Flooded with their Goods

More important still, they flooded the Straits Settlements with their goods to such an extent that on May 7, 1934, the British Government decided to fix quotas on all Crown colonies for foreign cotton and rayon textiles.

These quotas were based on the average textile imports of each colony from 1927 to 1931, and they cut Japanese imports into the colonies by 57 per cent.

Yet this was not the end of this trade war. Her goods are inferior to those of the West, and wall of international tariffs makes it possible for her to hope to break in the Western markets. Consequently Japan looks to Asia as the market she must develop.

She has attempted to counter Singapore by toying with the idea of a canal across the Malay Peninsula, high above Singapore, and entirely in Siamese territory. Investigation has convinced Japan now that this would be uneconomical.

So, the future of Singapore hinges on the intentions of Japan. Singapore, with its guns, its air and naval bases, its causeway across the Straits of Johore to the mainland, is not a threat to Japan.

Keeping Trade Route Open

It is designed to block a move which Japan may decide to make.

Even in a war, Britain could not attack Japan from Singapore. It is nearly 4,000 miles from Singapore to Tokyo, and the fighting range of a modern fleet is about 1,500 miles, of a bombing squadron 1,000 miles.

But, if Britain could block a hostile fleet at the Malay Archipelago, the trade route from Perth, Australia, to Colombo and Suez would be kept open.

And to attack Perth without passing through the Archipelago, a fleet from Japan would have to make a detour of nearly 5,000 miles round the southern tip of Australia without a base for refuelling.

Singapore's Civil Aerodrome

Closely related to the vast defensive developments of the general project at Singapore has been the growth through recent years of the aerial communications of the Port and the creation of the Singapore Civil Aerodrome, a great undertaking that consisted of converting an extensive area of swamp and jungle into a modern airport. This work measured into a huge excavation job and it is to be noted that Ruston-Bucyrus excavators were chosen to carry out this work. In all, eleven of these big machines have been in service, including nine 32-B 1 cubic yard electric shovels and grabbing cranes and two 10-RB three-eights-yard Diesel powered excavators.

The first excavators which were supplied were subjected to very severe performance tests in difficult sticky digging before they were accepted, but they passed through the tests with flying colors and more machines of the same type were ordered, until the aforesaid total was reached.

The aerodrome site is a large one, covering over 250 acres, almost all of which is being reclaimed from swamp land situated in the estuaries of three small rivers. The total quantity of material required for the earth filling, raising the surface of the ground and levelling involved the excavation of over 7,000,000 cubic yards of material.

The earth filling is being obtained from a large hill about four miles distant from the site of the aerodrome, and from here some 8,000 cubic yards of excavation daily is being obtained. The material or filling consists of heavy impervious clay and gravel, very sticky and difficult to dig, but in spite of this the electric shovels are giving an excellent account of themselves. The hill was attacked from the top in a series of shelves or benches about 20 feet high, the excavated material being dumped into steel double side tip wagons of three cubic yard capacity. Trains of 40 wagons at a time are being loaded and dispatched to the aerodrome site.

The clay and gravel with which the Singapore civil aerodrome is being filled is transported in trains of these double side tip wagons after it has been excavated

Filling in the swamp presented a difficult problem, but it is being successfully tackled as follows.

The site is divided into areas of 10 to 25 acres in extent by putting in dividing walls or bunds. The water is then pumped out of these areas, after which the ground is allowed to dry and harden by the heat of the tropical sun, in order to form a solid base for the filling which is being dumped in layers. Consolidation is being carried out by means of caterpillar tractors and road rollers.

Finally the ground will be covered with a special top dressing and turfed over with special grass selected because of its hard wearing qualities, and another link will have been added to the rapidly lengthening and improving of the World and Empire Air Services.

Channels for seaplanes are being excavated by means of Ruston-Bucyrus 32-B grabbing cranes mounted on pontoons. The work is proceeding very rapidly, and it is hoped to complete it sometime next year (1937).

JAPANESE ELECTRICAL DEVELOPMENTS

THE Japanese Imperial Government Railways are to complete the electrification of the entire Tokaido route. The Tokaido line is the most important and most congested in Japan. Part has already been electrified, but the remainder requires an expenditure of Y.30,000,000, which is to be distributed over five years. When the work is completed Tokyo and Kobe, 560 km. apart, will be connected by electric trains.

The Tokyo Electric Light Co. is to begin construction of the Shinanogawa hydro-electric plant early next spring. The plant harnesses the river Shinano and will develop 160,000 kw. It is said to be the largest in the Orient. Six years will be needed for the completion of the work, for which an expenditure of Y.54,000,000 is estimated. The output will be used to meet the ever-increasing demand for electric power in Tokyo and district.

The export of electric apparatus from Japan to Soviet Russia is increasing. Amongst the goods supplied as part of the purchase price of the North Manchuria Railway, 70 electric drills, costing Y.15,000 were exported to the U.S.S.R. by the Mitsui Trading Co. This is said to be the first shipment of the kind from Japan. It is expected that successive orders will be large.

The first radio telephone installation on a Japanese liner will be made on the *Chichibu-maru*. The apparatus consists of quartz-controlled 1 kw transmitter, and costs Y.100,000. The entire equipment is of Japanese manufacture. If the trial proves successful the Department of Communications is to install the same apparatus on all trans-Pacific and Europe-bound liners.

Frequent occurrences of earthquakes, floods, typhoons and other calamities have taught the necessity for the installation of a national network of radio communication. The Department of Communications has formed a project which will cost Y.10,000,000 to be spread over three years. Radio beacons, aviation and ordinary radio systems on a large scale are included. Short-wave stations are to be established at important places to communicate with aircraft and to dispatch urgent news.

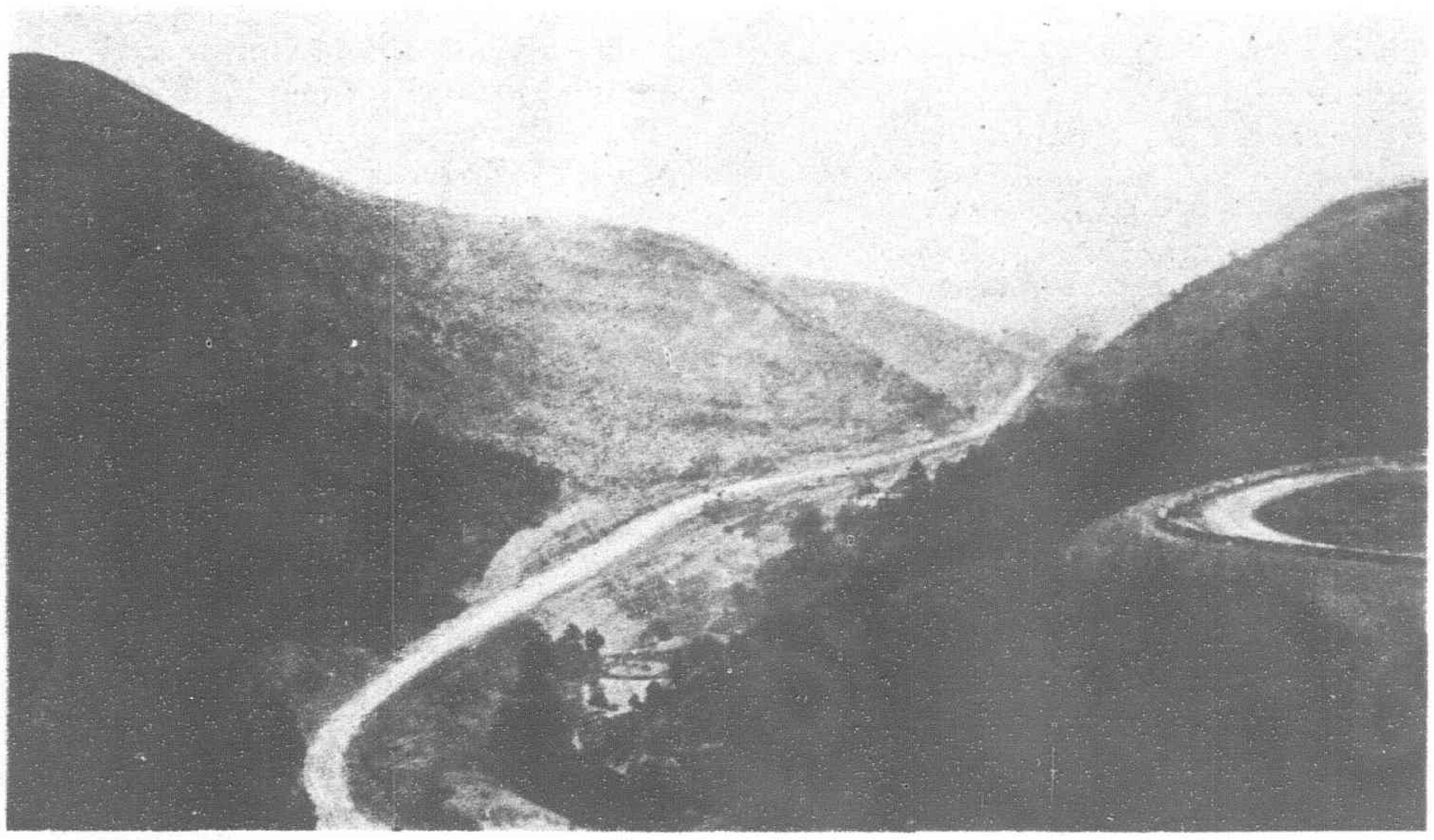
The Nippon Broadcasting Association has introduced a common reception system for farming and fishing districts; 10 to 50 subscribers are allowed to connect their speakers to the central receiving apparatus, which is furnished and maintained by the Association. Initial installation is free and the monthly charge per subscriber is very low, so that farmers and fishermen may enjoy the programs at small cost.

Notes on Highway Construction in the Provinces of Kiangsu, Chekiang and Anhwei

By WILLIAM H. F. WOO, Professor of Highway and Municipal Engineering, Peiyang University

THE development of highway construction in the south-eastern provinces of China in the Yangtze Valley has been a phenomenal one during the past few years. Through the joint efforts of the provincial governments and the Central Government acting through the National Economic Council, it has been possible to complete many thousand kilometers of needed roads and thus to form a highway network in this region which promises important interprovincial communications on land. Whereas in former years, many inland cities could be reached only after days or weeks of hard travel in sedan chairs or in boats, the same cities may now be visited after one or two days' driving. Passengers are now transported by comfortable buses at a speed which previously was not thought of, and some trucks are also being operated for hauling goods. Highway transportation has demonstrated its importance in China.

The National Economic Council is delegated to render help to the several provinces in the lower Yangtze Valley which are seeking funds for highway construction. The help is in the form of loans that are available under certain conditions and terms. Loans when available are made on prescribed roads and all roads benefited by the loans come under the supervision of the Council during construction. The writer, in connection with his work with the Council, has had, during the past few months, the opportunity of doing travelling and inspection on over 2,500 km. of highways in the provinces of Chekiang and Southern Kiangsu and Anhwei, that are either already completed or still in construction. In going over these roads, he noticed a great range in the methods and practices of construction. Many of these are in perfect accord with sound engineering principles, but there are many that do not seem to be so satisfactory.



A section of the road between Linhai and Hwangyen in Chekiang, and also one of the several switchbacks on the hill. Zigzag construction is quite common on the mountains and is adopted even where the topography permits of a better and safer type of construction

The purpose of this article is twofold : (1) to present a general picture of the existing practices in the different phases of highway construction in the provinces visited, and (2) to bring out and discuss the possible improvements on those practices and methods which the writer feels are not so satisfactory. The presentation is divided into the following headings : Alignment, Roadbed Construction, Surfacing and Structures. While it is the purpose to limit the descriptions and discussions to those provinces visited, yet the same are so general that they may be found to be true and applicable in other parts of the country as well.

Alignment

It is almost superfluous to say that good alignments are the most important step for successful highway construction. Our highway engineers have fully realized this importance and are paying due attention to the matter of alignment. In level and slightly rolling country, usually very satisfactory alignments are provided (Fig. 1). Whenever the old roadbeds are utilized without modification, the alignment becomes sometimes quite unsatisfactory, as most of the old roads were located without much consideration for engineering principles. Bad curves sometimes exist where they can be entirely avoided. These are mostly caused by an unsystematic change in the alignment of the adjoining sections of the road.

On the highways in the southern part of Anhwei Province, one notes many old stone bridges over which the highway lines run. Most of these bridges were so located as to make it very difficult to obtain satisfactory alignment on the approaches. In consequence, many awkward and dangerous curves are constructed at the ends of the bridges.

For roads going through a narrow valley with hills on both sides, the usual practice is to run the line at the bottom of the valley. To be sure, a road like this costs the least to build, as far as the construction cost alone is concerned, but usually the land in that strip is the most suitable for cultivation and the most valuable, so running a line through it means a sacrifice to many farmers who get little remuneration for the rendition of the land. Furthermore, low as it is, the road is subject to possible frequent inundations, and unless the grading is made high, which means extra construction costs, much has to be spent for putting the road into shape again every time after it is flooded. A better construction can usually be easily acquired at the toe of the hill. Located this way, it would mean the saving of the cultivated land and the avoiding of the floods. Undoubtedly, the construction costs will be more but this additional cost can usually be saved through reduction in the yearly maintenance costs.

Construction over swamps and the troubles resulting therefrom have not received sufficient attention from many engineers. As the water-saturated soil in the swamps has practically no bearing power, a roadbed placed on it will cause the spreading settlement of the soil and settlement will result. Worse yet, not all of the settlement takes place at one time, nor is it uniform. It is commonly true that settlement occurs even years after the construction has been completed. Before the final settlement has taken place, a great deal of repairing on the roadbed and surfacing is constantly required. The writer has had the opportunity of going through a section of road over 8 km. long that is built entirely on marshy ground. The result there is that in spite of consistent maintenance, little success has been secured in the alleviation of the degenerated conditions of the roadbed and surfacing. In this particular case, the road could have kept clear of the swamps by locating the line at the toe of the hills that lie near by. Swamps should be avoided whenever possible. If it is impossible to do so, fundamental construction must be done so that all future troubles are obviated. This consists of the removal of the muck, backfilling of hard and coarse materials and the laying of a layer of good soil on the top to receive the surfacing. The practice as used in the United States involving the use of explosives to accelerate the settling is too expensive a procedure to be followed in this country.

Closely resembling, but not as serious as, swamp construction is the locating of a road over rice fields. During the cultivating season,

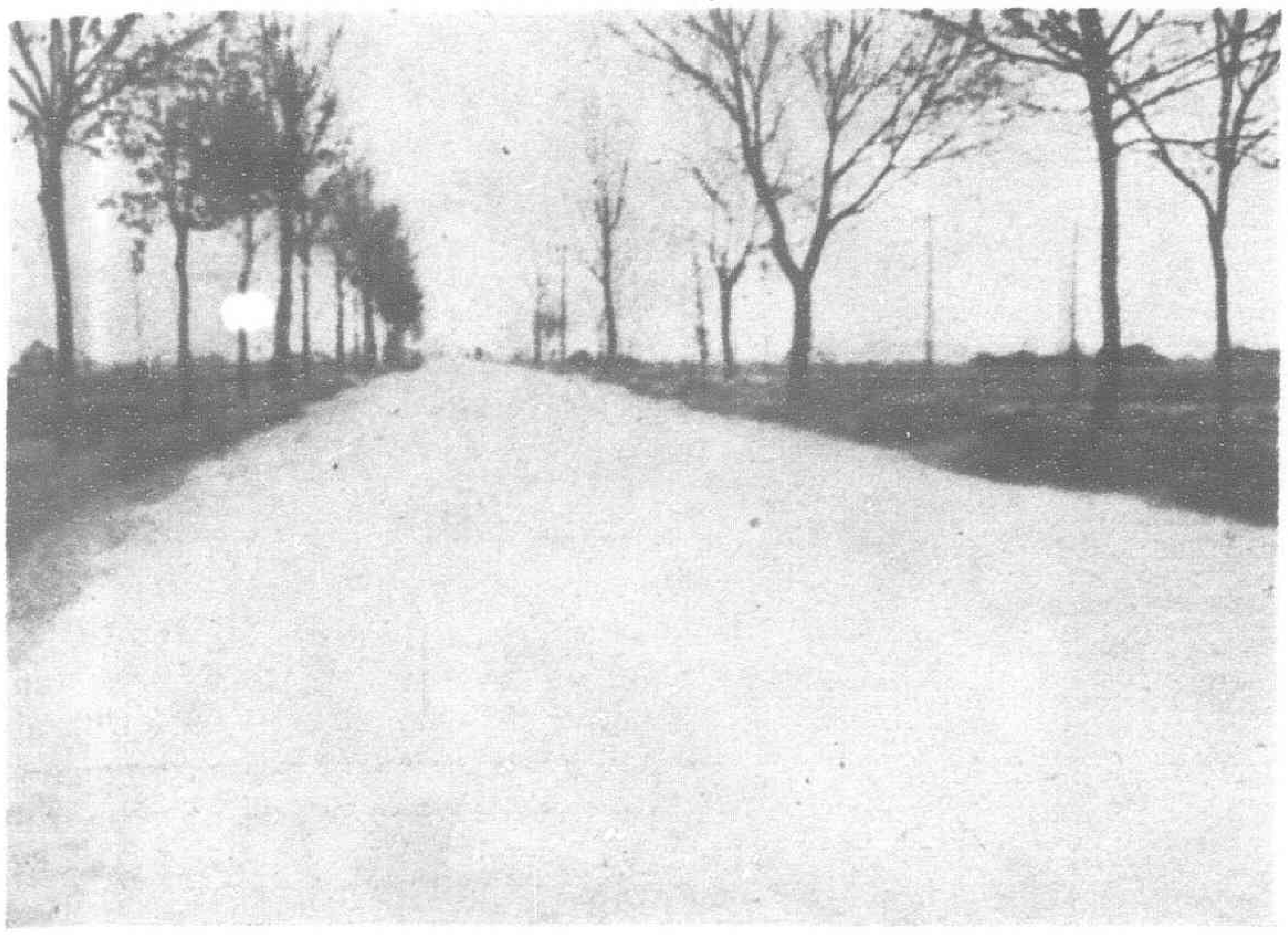


Fig. 1—The Hsiaoshan-Shaoshing road in Chekiang is well located, built and maintained. Is considered one of the busiest roads in China. Such straight alignment is prevalent in level country

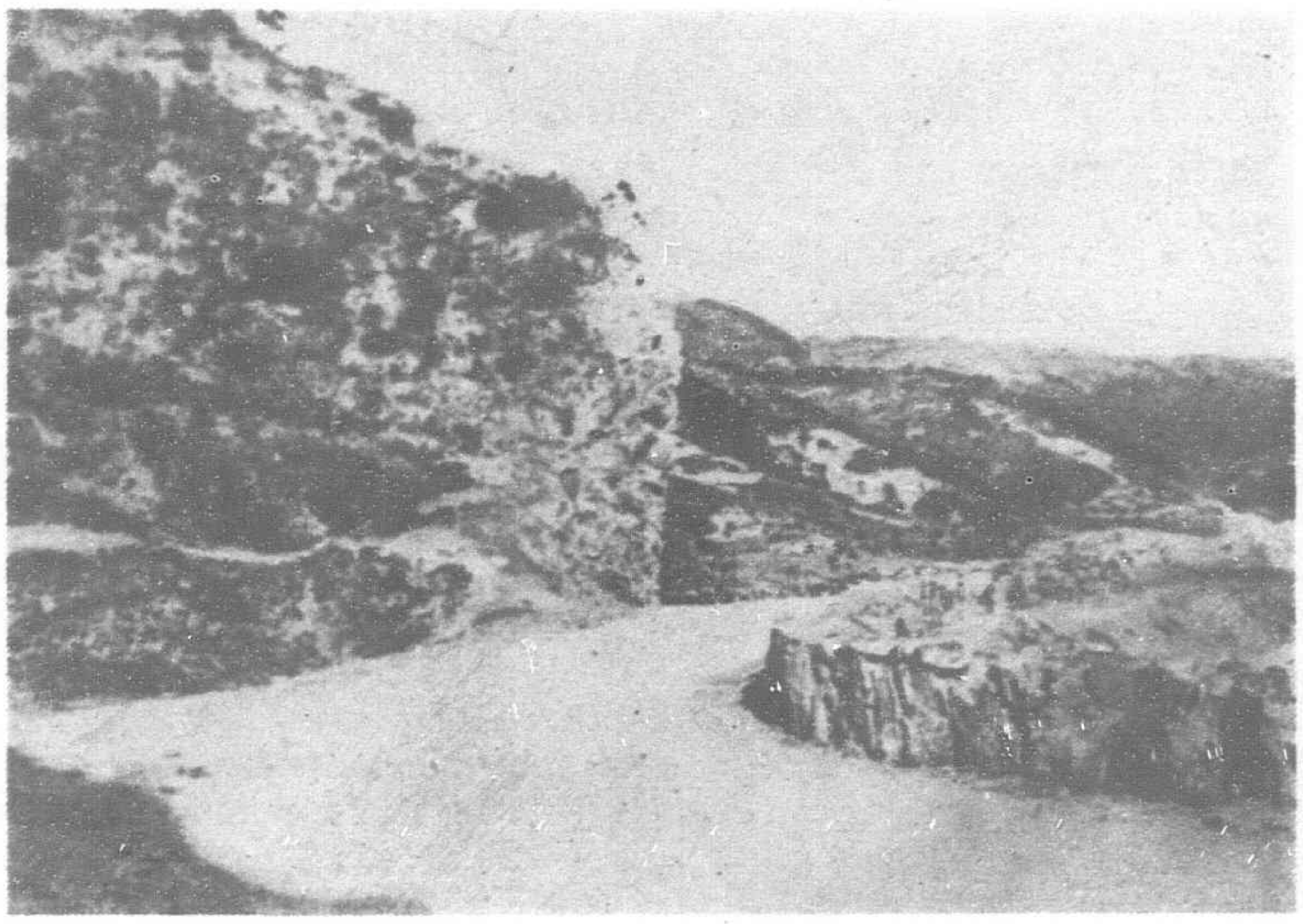


Fig. 2—Typical hillside construction where dangerous curves are occasionally encountered. This is a section of the road to Chikuo, the home town of General Chiang Kai-shek

the fields are flooded with water and constant pools are formed not only in the fields themselves, but in the side ditches of the road as well. If the grade of the road is not made high enough, water through capillary action rises to the top of the roadbed and greatly reduces the bearing power of the soil. Our highway engineers are now paying due attention to such construction and it is gratifying to note that nearly all roads over rice fields are now built with sufficient height above the surface of the water.

Roads involving rock excavation such as those going through gaps and those following a stream on one side and a hillside on the other usually do not have satisfactory alignments. Here one meets steep grades and sharp curves. In fact, many of these curves have in addition such bad sight distances as to have caused several fatal accidents (Fig. 2). In such cases, it was not that the engineers were not aware of the dangers or the inadequacy of such poor construction, but that generally insufficient funds at the time of construction prevented a better type of construction. However, many of these dangerous locations can be improved at little additional cost. Considering the speed of the traffic that we have on the highways in China in the present day, sharp curves are not so objectionable, if reasonable sight distances are provided so that the driver can see in advance the curves he must deal with as well as the movement of the cars coming in the opposite direction, thus giving him time to adjust his speed accordingly. The worst alignment is that of a blind turn preceded by a long stretch of tangent or by a long descending grade on which the driver tends to assume a high speed before reaching the curve. Alignments like these, unfortunately, are rather frequent, and they need improvement most badly. One kind of temporary redress to these dangerous places is the erection at the curves of special warning signs, designed with special regard to conspicuousness and effectiveness, to replace the ordinary curve signs which are being used so much as to be very ineffective in indicating the kind of danger.

The method of construction of mountain-climbing roads deserves some comment. At present, there seems to be a general preference for switchback construction, regardless of the topography of the hills in question. The writer has gone over certain sections of the roads, in Anhwei and Chekiang where as many as five or six switchbacks were encountered in a climb of 2 or 3 km. (See Frontispiece). The grades on these roads are often more than six per cent and the radius of curvature at the switchbacks is usually little over 10 or 15 m. Heavily loaded buses and trucks have difficulty in dealing with these grades and curves. The greatest difficulty is experienced at the curves where the vehicles must bring down what little speed has been established on the straight grade in order to make a safe turn at the curve, thus leaving but little energy available for another stretch of climb after the turn. Some of these hills are of such a topography that long sweeping continuous grades can be constructed in their stead. The cost will most probably be less and a far more satisfactory alignment obtained.

For roads going through mountain ranges, the practice is usually to make the alignment follow the stream in easy grades (Fig. 3). This may give rise to three disadvantages : (1) excessive lengthening of the total distance between the two given terminals ; (2) too much rock excavation ; and (3) the danger of getting flooded by the stream. Items (1) and (2) may sometimes cause unreasonably high construction costs. We learn a great deal about building roads on top of mountains in the United States. The advantages of these high-level roads are just the reverse of the disadvantages of the stream-following roads. With the exception of a short section in Chekiang, the writer has not encountered any of these high-level constructions. The fact that our highway engineers are not prone to the consideration of the hill-top constructions may be accounted for by the following reasons :

(1) In the prevalent practice of highway construction, the locating engineer is usually not given sufficient time to enable him to thoroughly inspect the country and look over and compare the merits of all the possible routes of travel. On account of the great saving in time, he is liable to select that one on which it is most convenient for him to travel during the reconnaissance.

(2) Most of the roads through the mountainous regions are located in close proximity to the age-old footpaths. These footpaths often have easy grades but are winding and lack directness. Modern roads located with respect to them are apt to have the same characteristics.

(3) There is no precedent for such construction.

In concluding the comments on the current practices on highway location, it is necessary to restate that the alignment is generally satisfactory in level or rolling country, and advantage is usually taken of the topography to make the construction economical. Here the curves and grades are easy. Stream crossings are usually perpendicular to the direction of the flow, although this is sometimes overdone. In mountainous regions, the alignments are not as satisfactory. Here traffic demands on alignments are not fully observed, being limited by financial considerations. Here sharp, blind curves are often made to save construction costs. Better alignments can sometimes be obtained if sufficient time is allowed the locating engineers for inspecting and comparing all the possible routes of travel. However, many of the dangerous curves can be improved at little additional cost. Switchback constructions are plentiful on the hill-climbing roads. They are a source of hardship to the ascending vehicles and dangerous to those descending. Such constructions should be discouraged.

Roadbed Construction

The present methods of roadbed construction in the several provinces visited are unsatisfactory in several respects. The greatest defect of the construction is that the filling of the roadbed is not compacted while it is being built up (Fig. 4). The earth, in small lumps and generally transported by man power, contains a great many cavities. The workmen, in carrying the earth, walk over a few definite courses, so even such compaction as may be attributed to their stamping is limited to a few strips. Settlement of the fill occurs on nearly all roads, and generally the higher the fill, the worse the settlement. As the settlement is never uniform, it sometimes causes great damage to the surfacing. As the writer sees it, there can be no objection to piling up the loose earth in this way if enough time is given to allow for compaction by rains and the weight of the traffic before the costly surfacing is put on. But usually, as construction in recent years indicates, there is so much hurrying with the work that this is not permitted, with the result that new surfacings become indented and distorted within a short time after they are completed. Repairing of such surfaces is difficult and expensive, and only with great difficulty may the original grades and cross-sections be restored.

The greatest reason for the omission of compacting the fill is that of economy. The writer wishes to suggest here an inexpensive method of compacting the fill which involves the use of heavy work animals like cows and horses and light rollers which they will drag. By leading the animal back and forth on the fill while it is being built up, much compaction can be done by its four hoofs and the light roller weighing not more than 200 lb. which it drags over the unstamped portion of the fill. Work like this would not be too hard for the animal, and the writer believes one animal working like this would be able to cover enough area every day to make its use economical. An added advantage is that it would not interfere with the men on the job.

Judging from the lack of adequate drainage provisions in certain sections of the roads, it seems as though this drainage problem is not receiving as much attention as it should. As a matter of fact, drainage in highway engineering, is next in importance only to alignment. In going over the roads, the writer noticed the following kinds of common defects : (1) side ditches in through cuttings which were too narrow and shallow (2) lack of longitudinal grades and outlets to the ditches, so that water collected by the ditches remains stagnant at the sides of road, and (3) not enough cross culverts under the hillside roads. Of the three defects (1) and (2) can be easily and cheaply remedied by the maintenance workers and the materials removed from the ditches can be used for reshaping the shoulders, or, if suitable, used as a cover for the surfacing. The third defect occurs quite frequently on hillside roads. The purpose of the cross culverts is to drain the water intercepted by the ditches from the hillside due to rainfall and seepage. If the ditches have good longitudinal slopes, fewer of these cross culverts may be provided, but if they are on a level or slight grade, they must be put in at intervals of not more them 150 or 200-ft. Spacing them too widely apart causes the water to flow over the top of the road and results in damage to surfacing and roadbed. The writer has gone over several sections of hillside roads in Anhwei and Chekiang where cross drainage is neglected. At many places, continuous pools of water were formed after the rains, covering a great part of the roadway, and were it not for the subgrade being of rock, much of it would have been washed away. To install these cross culverts after the construction is completed involves some rock cutting and interference with the traffic, but if they are put in during the construction, the expense is negligibly small. The resulting benefits are great enough to warrant a careful consideration when construction is first assumed.

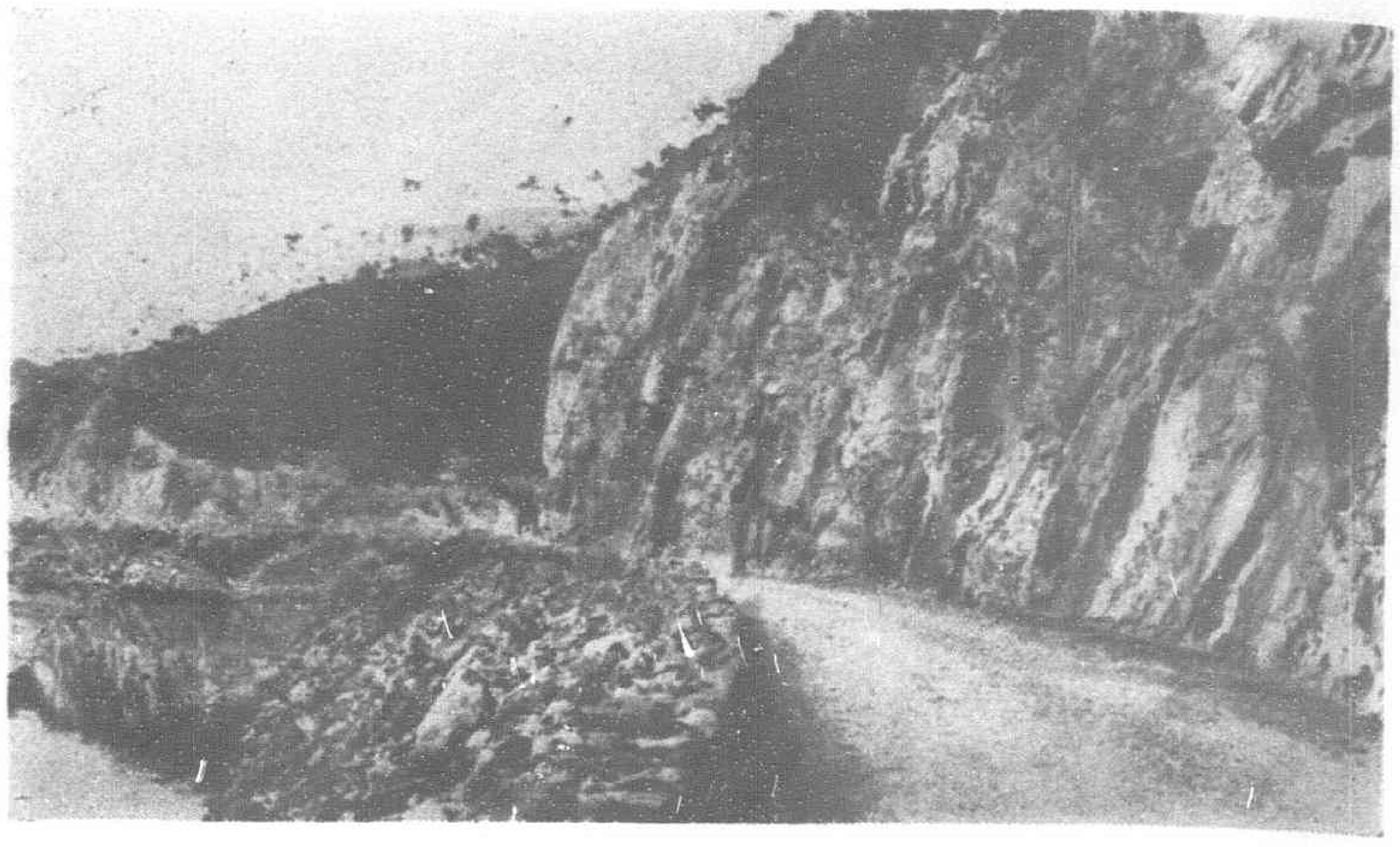


Fig. 3—In the mountainous regions such alignment as this, following the stream, is typical. Low-level construction of this kind seems to gain preference over hill-top construction

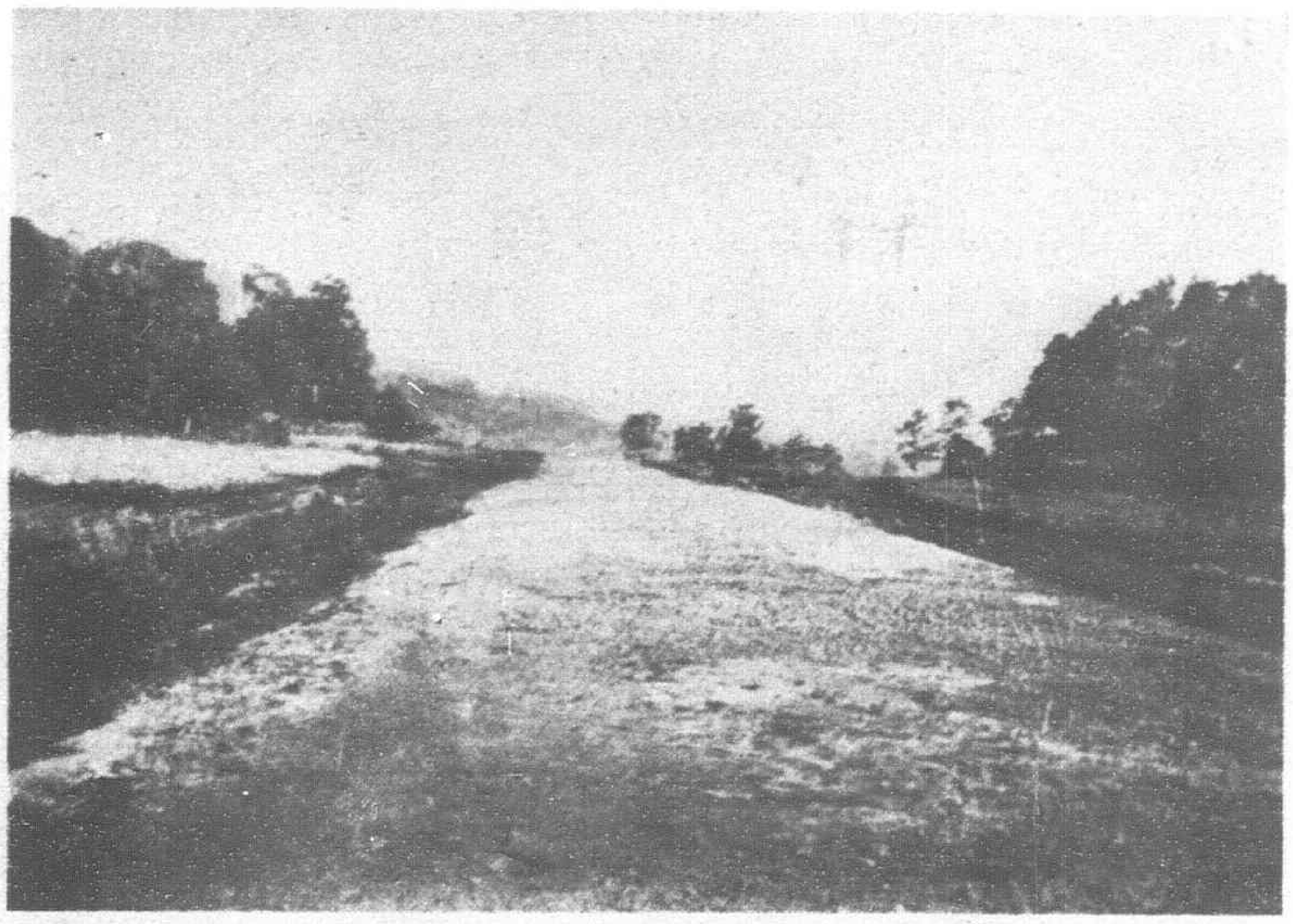


Fig. 4—In Anhwei this typical high hill, not yet surfaced, was built up without any compaction. It shows undulating surfaces which have resulted from rains and the weight of the traffic

Another thing in connection with drainage is the lack of provisions for retarding the flow of water in those long side ditches on steep grades. The result is that during the rain, much soil is carried away by the water, thus gradually affecting the stability of the subgrade. To prevent this, a series of small dams should be built in the ditches at a spacing depending upon the gradient of the ditch. Almost any material that is hard and heavy may be used for the construction which may be very crude. The dams should be porous, thus allowing the draining of the residual water.

On the main roads, the width of roadbed of ordinary earth construction is generally 7.5 m. This width is sufficient for a surfacing about 20-ft. wide, and shoulders 2½-ft. wide on each side. Considering the present traffic, this width is quite sufficient. However, owing to the piling of surfacing materials, for maintenance, on the sides of the road, usually not the full width is available for the use of the vehicles, and the passing vehicles have to slow down quite a bit to make sure of sufficient room. In places of rock excavation, where construction is much more costly, the width of the roadway suffers great reduction, and many so-called single-track roads are constructed. Such construction undoubtedly has its economic justifications, but in adopting it, there are two points that must not be overlooked, safety and convenience. In order to secure safety, good sight distances should be had on the curves, and when this cannot be obtained, special warning signs should be erected as has already been mentioned. Convenience is concerned with those long hillside roads where cars have frequent chances of passing each other. On these roads, turnouts wide enough to accommodate two cars, should be provided at intervals of not more than 200 m. They must be clearly indicated with signs denoting their use. The omission of these signs would reduce their usefulness, as drivers, in moving cars, are not quick to detect, by themselves, the sufficiency of the width.

Surfacing

Highway surfacing is a necessity in the south-eastern part of China on account of the heavy precipitation throughout that region. With surfacing the roads are passable in all seasons of the year. Nearly all the roads constructed with the aid of the National Economic Council are provided with one type of surfacing or another. Several types are in use, but all may be classified as low types according to the standards now prevailing in highway engineering. However, as the traffic in China is light, these forms of low-type surfacing, when properly maintained, provide an easy-riding surface, enabling the vehicles to proceed at a speed of 30 to 40 miles an hour (Fig. 5).

The different types of surfacing may be divided into two main kinds, clay-bound and paved. Gravel, broken-stone and broken-brick constructions belong to the former type. To the latter belongs that unique type of construction known as the Tan-shih pavement which for a while was greatly favored by highway engineers but is now being gradually abandoned for reasons to be given below.

In clay-bound constructions the binding material for the road metal is clay. The methods of construction are quite similar for all the types that are in this category. They consist of first digging a

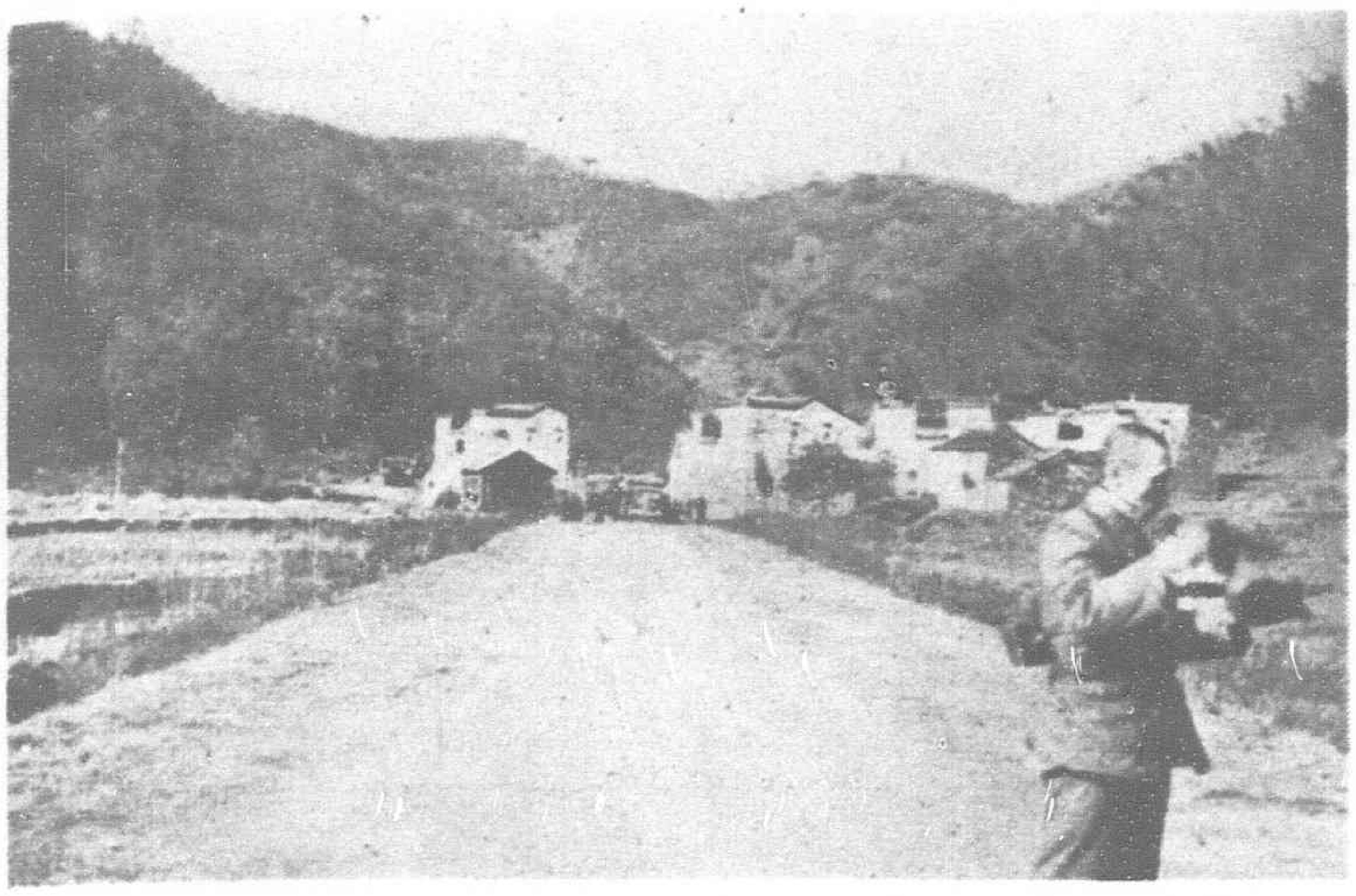


Fig. 5—A properly maintained highway in southern Anhwei. Autos can travel thirty to forty miles an hour comfortably on such a road

trench on the roadbed, spreading the material for the bottom course, grouting with clay, rolling and then covering with a top-layer wearing course consisting of either pea gravel, stone chips or sand-clay mixture. Broken-stone roads have been giving the most satisfactory results ; gravel roads are less satisfactory and broken-brick roads are the least so. Broken stone, by virtue of its sharp, rough surfaces, holds together very rigidly once the particles are compacted and bound up with clay. Gravel has smooth surfaces and cannot be compacted easily. The only way one may expect to have good compaction with this material is through thorough rolling, under which action the larger particles break up, making it easier for all to hold together. Broken brick is not a satisfactory material because it is too fragile, making the permanence of compaction impossible, however thoroughly it may have been done at the start.

Fig. 6—A small section of Tan-shih pavement

In clay-bound roads, the following defects in construction have been noticed :

(1) Too great coarseness of the coarse aggregate which also is lacking in gradation. Whereas for good construction, the coarse aggregate should not be more than $2\frac{1}{2}$-in., larger sized material has been more often used than not, this being especially true with gravel roads. In the first place coarse materials are difficult to compact and later tend to ravel easily when the top wearing course is removed. Gradation of the size helps compaction greatly, but this is often neglected.

(2) Insufficient thickness of the surfacing. This is a direct result of financial limitations in highway construction in recent years. In fact, the standard of construction has been gradually lowered to such an extent that one may question now whether the safety limits have not been exceeded. In the case of gravel and stone surfacing, a 6 to 8-in. thickness is probably the least that should be provided on the bases of the load-carrying and wearing requirements. Proper thickness is necessary for distributing the wheel load over a safe area on the subsoil. This area varies somewhat with the square of the thickness, hence even a slight reduction in thickness tends to affect greatly the bearing area and unit pressure, other things remaining the same.

(3) Overdosing of the binding clay. This makes the road slippery when it is wet and offensively dusty when dry. It can be remedied easily by applying a heavier wearing course.

(4) Insufficient compaction. This usually means that not enough rolling is done with rollers that are sufficiently heavy. While several roads have been compacted with heavy machine rollers of seven tons or more, many contractors still rely upon small man-powered rollers as the chief means of attaining compaction. These rollers weigh only about three tons, giving a pressure of about 120 lb. per in. Roads that do not have sufficient thickness and that do not have enough compaction will have the effects felt upon the maintenance costs, as more maintenance will then have to be done.

(5) Lack of superelevation on curves.

The name of Tan-shih is given to that type of pavement consisting of irregular pieces of stone about 6-in. long in the longest dimension laid tightly with each other with their broadest surfaces upon a bed of cinders or sand (Fig. 6). The stones are hammered into the bedding course and as they are irregular in size, the smaller ones are placed between the larger ones to obtain the necessary wedging effect. After the stones are in place, the pavement is covered with sand or cinders which are swept into the voids before the rolling is done. This type of pavement has been more widely used in Kiangsu than in other provinces. The advantages claimed for it are that it is durable because the surface of the stone itself is subject to the grinding of the wheels ; that it is low in maintenance cost because there are practically no loose particles that may be picked up and thrown away by the vehicles ; and that it has a high salvage value. Counteracting these advantages may be mentioned the following shortcomings. First, this type of surfacing does not possess a smooth riding surface due to the fact that the top surface of the stone is not regular. Moreover upon being open to traffic, the blocks undergo unequal wear and uneven settlement. Whereas in the case of gravel or broken-stone roads, slight irregularities that develop on the surface are remedied by the application of another coat of wearing course, such a method is impossible with Tan-shih pavement. Of equal importance is the fact that it causes a tremendous amount of wear and tear on the tires of the vehicles, and the slight continuous jerking motion is detrimental to the different parts of the moving vehicles whether they may or may not be noticeable to those who are riding. It has a poor drainage surface, and hence, requires a greater cross slope which contributes further discomfort to riding. I feel that this type of pavement does not fulfil our modern traffic requirements, although its cost is somewhat higher than the gravel or stone roads already mentioned.

We realize that in highway engineering as in any other engineering, construction and maintenance costs are closely related to each other. The reduction of one always tends to result in the increase of the other. At present in China, with the financial resources limited and the traffic light, there is no justification for constructing high-type pavements. Costing often as much as 40 per cent of the total construction cost of the highway, and accompanied by subsequent high maintenance cost, the construction of low-type surfacing probably constitutes the most difficult problem in highway construction in China, to successfully solve which would require the most thorough attention of our engineers. To secure satisfactory results, a great deal of research and experimenta-

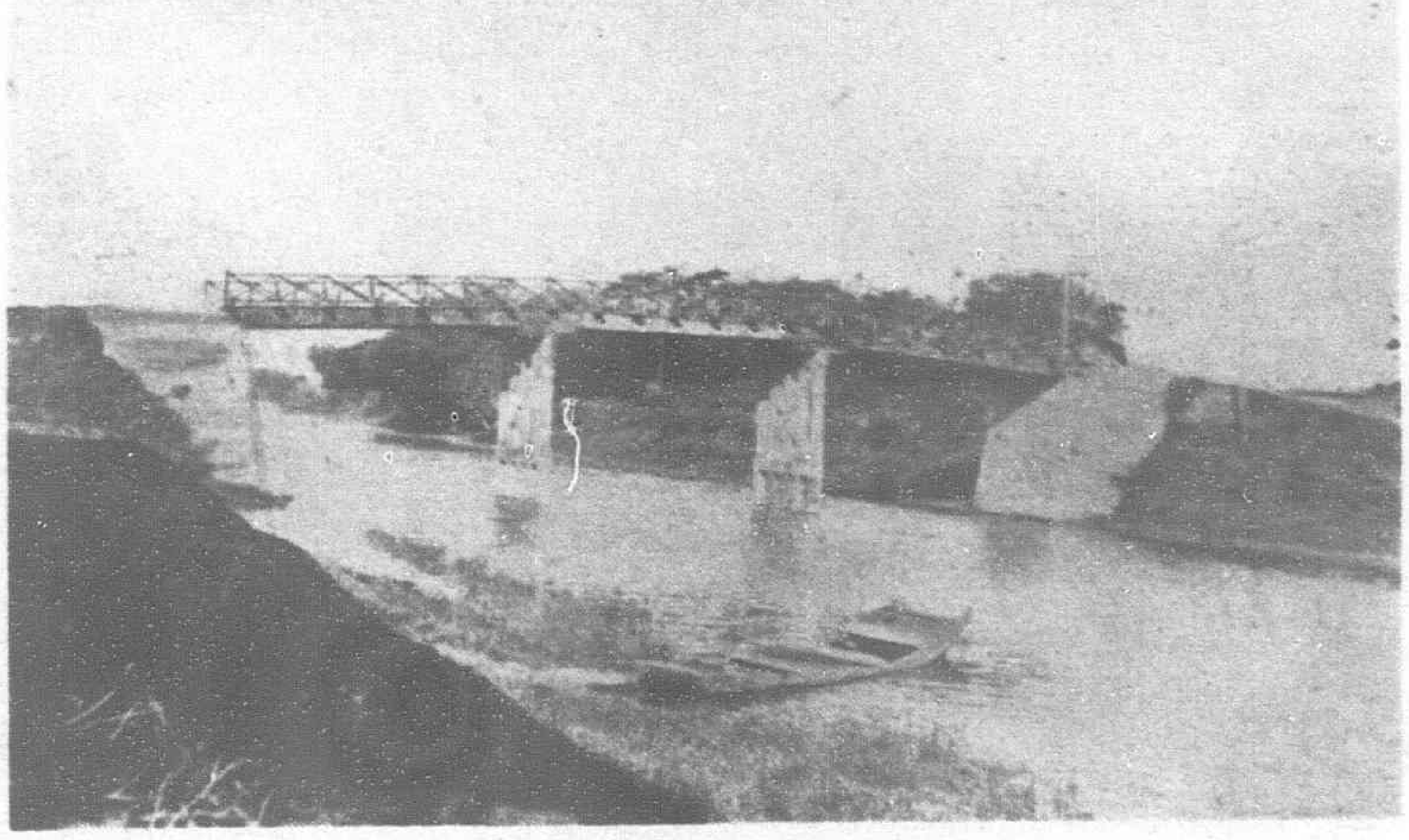


Fig. 7—A typical semi-permanent bridge with masonry or concrete substructure and timber superstructure. This type is not economical as a permanent structure

tion seems to be necessary not only on the surfacing itself but also on all such factors as may have a bearing on it. The aim is to decrease the present rate of high maintenance costs without increasing the construction costs to any extent. Success along this line would mean considerable saving to the total annual highway expenditure.

Structures

Highway structures refer to, in the main, bridges and culverts, which will be discussed separately. Highway bridges command interest in several respects:

(1) By virtue of their high cost. Analysis of the cost of highway construction in south-east China shows that, disregarding special bridge construction, the cost of the bridges on a highway may vary from 20 to 60 per cent of the total cost of construction, covering a length that is but one to six per cent of the total length of the road.

(2) By reason of the great variation in the controlling conditions at the bridge site, thus requiring practically a separate design for each bridge.

(3) Because of their ornamental qualities.

At present it is generally the practice of the different provinces to omit the construction of large bridges, say, at those places requiring bridges consisting of a series of over 40 m. spans and involving some difficulty in the construction of the substructure. At these locations, ferry service is provided instead. On the other hand, streams of normal size and conditions are usually bridged.

The type of bridge that is most commonly used now is what is known as the semi-permanent type which consists of a permanent substructure of masonry or concrete and temporary superstructure of timber (Fig. 7). The latter is usually of ordinary beam construction with a maximum span length of about 10 m. There are about nine lines of beams under the floor. The timber for the main members is usually imported. They are designed to carry six to ten ton loading. For larger spans, timber trusses are employed. In general, carpentry in truss work is not very satisfactory and defects such as loose joints and bolts of uneven bearing which would cause great uncertainties as to the load-carrying capacity of the truss are sometimes observed.

Permanent structures of stone, concrete and steel have not been as widely used as they should be. The arguments favoring the construction of timber structures are:

(1) That they are economical. The first cost of a timber bridge is supposed to be much lower than that of a permanent one. This argument is, however, only partially true. Where native timber is not obtainable, the cost is apt to be quite high and a concrete bridge, as I have proved with a design which I worked out as a standard structure of the National Economic Council, can be built with little, if any, additional cost.

(2) That a timber structure is easy to construct, requiring in most cases almost only such time as is needed in waiting for the timber to arrive. But what about the delay to the traffic which results from frequent damaging and repairing of the bridge? On the other hand, the time ordinarily required for the construction of a permanent bridge can be very much reduced through standardization of designing and construction methods, adoption of a specially organized working gang, improvement in co-ordination of the administrative and engineering force and other factors that may cause delays.

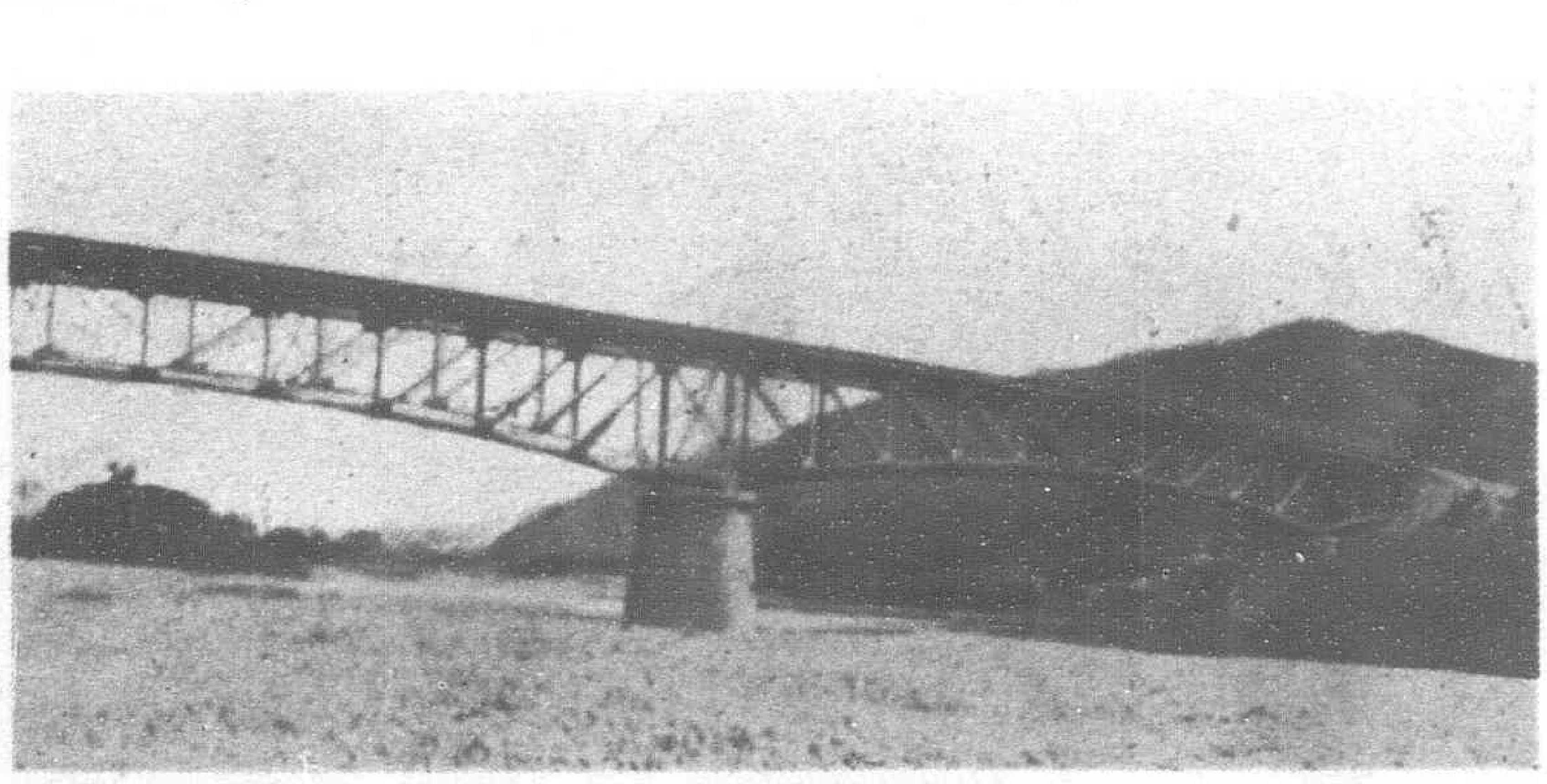


Fig. 9—Two-span continuous steel truss bridge on the road to Chikow Chekiang. The laterals are partly omitted and those that are provided are too light. Wind and traffic cause vibration

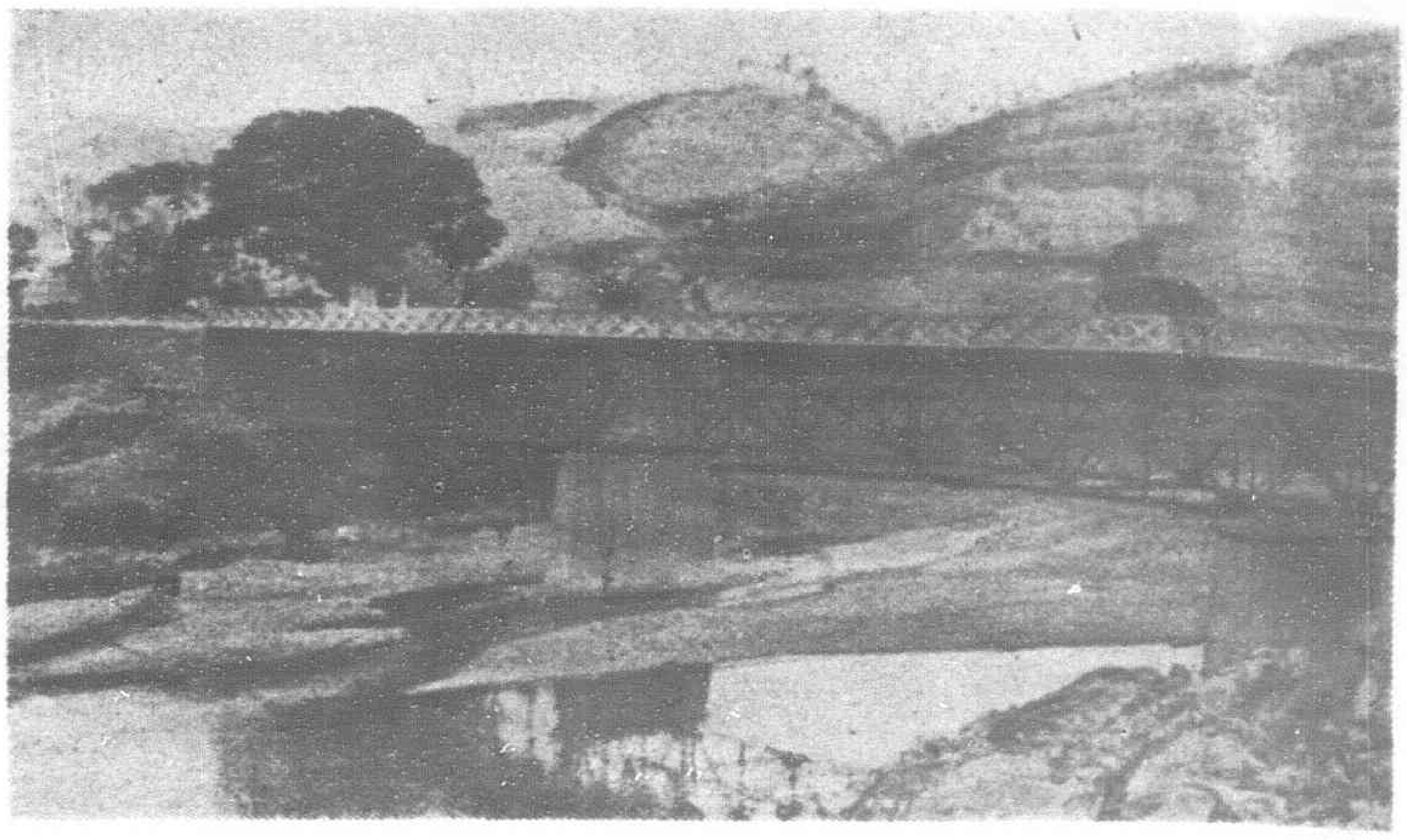


Fig. 8—A deck steel truss bridge in Chekiang. The floor and railing are of timber

(3) That timber bridges require fewer intelligent workers. Through proper arrangement and standardization, the construction of ordinary permanent bridges should present no great difficulty. Waiving the arguments in favor of it, we see that a timber bridge has a short life; its maintenance cost in high; its load-carrying capacity becomes questionable when decay starts; and its fire risk is large.

Of the relatively few permanent bridges that have been built, the most commonly used type is the one of steel I-beam spans covered with either a concrete or timber deck. Stone arches are frequently used in mountainous regions. The spans of these structures are 10 to 20 m. For longer spans, steel trusses of the deck type are often used, the floor being timber (Fig. 8).

It seems that sometimes sufficient attention has not been given to the detailing of the structure. Among the defects of this kind may be mentioned lack of drainage of the floor, unsafe design of the support, lack of expansion joints, inadequate design of the curb and railing, etc. In the steel spans, sometimes the laterals are too light, resulting in great vibration of the structure when a car passes over it (Fig. 9).

Another kind of mistake which is apt to be made is the lack of adequate surveying of the two approaches previous to the designing of the structure. Because of this omission a bridge, while under construction, may then have to be lengthened, shortened or changed otherwise to suit the topography that is not what it had been understood to be. This situation may lead to a poor-looking structure. Also, as the present tendency of using timber is too extensive, local materials are not as widely utilized as they should be. In mountainous regions where stone, gravel, sand and low-grade timber are easily securable, the most suitable type of bridge is concrete. It is absurd to construct timber bridges under these circumstances.

As one type of substructure, concrete pile bents are so widely used as sometimes to be entirely unsuitable to the physical conditions. When properly used, pile bents are both suitable and economical—economical, in part, due to the fact that they need no cofferdam construction. The ideal location for the use of pile bents is where the depth of the river is not too great and the foundation consists of a layer of clayey soil overlying a bed of sand or other coarse material, the latter material supplying the necessary supporting power to the end of the piles and the former, the lateral support. If the bearing power of the piles is to be derived from the surface friction, then the bent construction ceases to be economical, as longer piles will then be needed. In this case, it will be more economical to use the ordinary masonry piers resting upon short timber piles.

In going over the hilly section of Anhwei and Chekiang, one notices the many old masonry arch bridges over which the new motor roads are routed. All of these bridges are beautifully proportioned and many of them are several hundred feet long (Fig. 10). As most of them have had a chance to withstand extreme flood conditions, it is safe to utilize them for the new roads, at least from the drainage point of view. In many cases, they are extremely sound structurally and require practically no modification to receive the weight of modern traffic. In some cases, the original bridge floors are so smooth as to resemble a finished concrete surface. But in spite of all these favorable conditions, it is necessary to do some precautionary work on the bridges in order that they may not suffer from untoward damage and failures. The piers which were mostly constructed without regard to discharge efficiency, should be protected from scouring and undermining. All the joints of the stone should be pointed with cement for watertightness and good bearing. The railing should be made more rigid and, if the bridge floor is not smooth enough, it should be made over so as to reduce the impact of the vehicles. The cost of these changes and others are usually negligibly small.

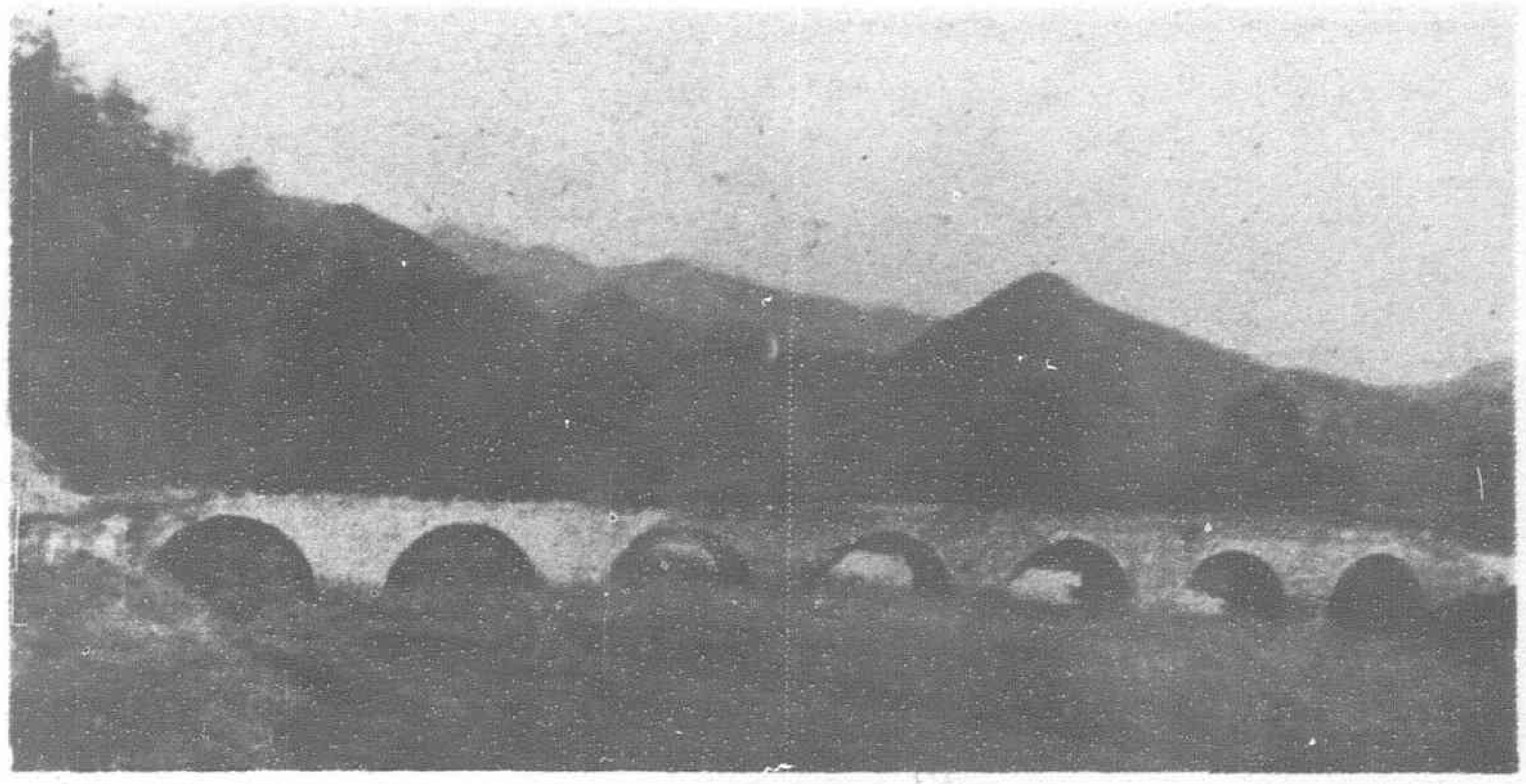


Fig. 10—This old stone arch bridge in southern Anhwei is beautifully proportioned and structurally sound. A new road has been routed over it. By utilizing it the cost of a new bridge was saved

Talking about culverts, one may say that as many types of culverts are now in use on the highways as are known to exist. The concrete box, stone box and pipe culverts are the most commonly used. Little comment need be made about the construction of culverts as both the designing and construction have been so universally standardized. In long box culverts, a transverse joint is necessary at the center of the structure in order to prevent cracking there. Stone box culverts are built whenever the materials are readily procurable. The slabs are often obtained from side roads that are to be discontinued. In the larger culverts, the slabs are replaced with native logs put in without any protective treatment.

Of the pipe culverts, two kinds are in general use, namely, concrete and imported corrugated iron pipes. Of the two, concrete pipes are the more widely used. Their diameters vary from 6 to 30-in. In my opinion 6-in. pipes should not be used anywhere as they are too easily clogged. Pipe culverts are sometimes laid too shallow and in some cases the alignment is not very satisfactory. Nearly all culverts have headwall construction which is not as economical as lengthening the pipes to project beyond the toe of the fill and omitting the headwall entirely.

Conclusion

In the above I have presented a general picture of the different methods in different phases of highway construction and have made such liberal comments as I feel justified in doing, subject to the judgment of my fellow engineers. The problems of highway engineering in this country are somewhat different from those in Western countries. Here, the main controlling factors are limited finance and light traffic. As a consequence, engineers are justified in the consideration of only such constructions as are not only low in first cost but in maintenance cost as well. Through studies, research and experimentation, probably much can yet be done to evolve constructions that are low in both costs. The problems are many and difficult, but they are worth delving into. To assume this burden, probably the most qualified organization, politically, financially and technically, is the National Economic Council which has been doing a great deal of initiative work in other phases of highway transportation. The development of special rollers and the addition of the proper amount of different soils to secure the proper compaction of the roadbed; the use of cheap hemicals, and the gradation of aggregates for surfacing; the use of principles of continuity for designing structures; the further standardization of designing and construction methods; the isolation of slow and detrimental vehicles; improvement in the organization and co-ordination of the working organs;—these are but a few of the problems on which investigation may be profitably conducted.

THE CHINESE ELECTRICAL MARKET

In his report on the trade and economic conditions in China Mr. A. H. George, Acting Commercial Counsellor at Shanghai, points out that many of the difficulties with which China has had to contend since 1931 have not been of her own creation. The balance of payments, which has turned against her, was due rather to world conditions. It is some years since China began to put her house in order, and while the record of achievement is comparatively small, there is now a greater security and stability in the country than there has been for many years.

Dealing with the trade with the United Kingdom, Mr. George states that produce and manufactures to a total value of £6,514,400 were exported to China in 1934, and merchandise to the value of £6,142,610 was imported from China in that year. In addition, domestic exports from the United Kingdom to Hongkong were valuedat £2,512,629, and imports consigned from Hongkong were valued at £421,732. Imports of prime movers are subject to great fluctuations, due to the execution of individual projects. The largest contracts placed recently have gone to Germany, which in 1934 secured three contracts for turbo-generator sets of 15,000 kw. each, and one for a 10,000 kw. set; United Kingdom firms in 1934 secured one contract for a 500 kw. set and one for a 250 kw. set. The principal supplier of electric transformers and parts and of miscellaneous electrical machinery, was the United Kingdom. These supplies, however, do not include dynamos, generators and parts (valued in 1934 at $1½ millions), and electric motors and parts (valued in 1934 at $2 millions), the bulk of both of which came from Germany.

Germany and Japan each supply about 15 per cent of the imports of electric cables. Though there have recently been signs that the rapid rate of expansion of this market has not been maintained, the increased popularity of electricity makes it certain that large supplies of electric cables will continue to be required. In 1933 and 1934 Germany was the chief supplier of telephone and telegraph instruments, with 35 per cent of the total imports in 1934; Belgium provided 24 per cent and the U.S.A. 13 per cent. Imports from Belgium in the first quarter of 1935 were valued at over $500,000, compared with $20,000 in the first quarter of 1934. Imports from Japan, Sweden and the U.S.A. also showed small increases in the first quarter of 1935, while those from the United Kingdom and Germany declined. The United States is the largest supplier of radio sets and parts, though the value of American exports to China in the first quarter of 1935 declined, as was also the case with imports from Germany; imports from the United Kingdom and Japan showed increases over the corresponding period of 1934. There is a growing market in China for radio sets and parts.

Considerable progress has been made during the last two years in connection with the extension of radio-telegraph, telegraph and telephone services in China, and it is proposed to introduce radio-telephone services. Direct radio-telegraph communication has been established between Shanghai, San Francisco, Berlin, Paris, London, Tokyo and Rome, and radio-telegraphy is also growing in popularity for internal communication, and large contracts have been placed with United Kingdom manufacturers for equipment for high-speed radio telegraph stations.

Coal Liquefaction in Manchuria

The immediate construction of an experimental coal liquefaction plant at Fushun capable of producing 20,000 tons of oil annually, was decided at a conference of South Manchuria Railway officials.

The plans of the S.M.R., it is stated, provide for the building of a factory capable of ultimately supplying the demand of the entire Japanese nation, which to-day is estimated at 3,500,000 tons, the bulk of which is now supplied by foreign concerns.

The coal liquefaction process, it is stated, is entirely Japanese, and the machinery to be installed in the plants will be almost exclusively Japanese. It is understood, however, that the British coal hydrogenation process for the production of oil, will be incorporated in the plant at Fushun.

The Oil of the Far East

A Comprehensive Review of the Situation in its Most Recent Aspects as Seen Through Japanese Glasses

By the Tokyo Correspondent of The Petroleum Times

JAPAN's share of world oil production is meagre, being merely 0.13 per cent, while the United States claims 75 per cent. In 1934 world production amounted to 1,542,420,000 barrels and consumption to 1,438,000,000 barrels. The consumption that year in Japan, excluding Government requirements, was 18,000,000 barrels, of which 2,000,000 barrels were met by purely domestic production. Thus, as much as 90 per cent of the country's needs had to be imported as crude or refined.

The Nippon, Mitsubishi and Ogura oil companies, which operate refineries at various points, import only crude oil, and mostly from the United States. In fact, more than 90 per cent of the crude imported in 1934 originated in California. Importation of manufactured products like gasoline and heavy oil is carried out mostly by two companies, the Socony-Vacuum and the Rising Sun, which do not import crude oil.

The past thirty years the two foreign oil companies representing British and American interests have dominated the Japanese oil market. Meanwhile, with competition keen and persistent, the path of Japanese companies has been anything but rosy. In 1931 a flood of imports of petroleum and its products, in anticipation of the impending re-imposition of the gold embargo and of the raising of the tariff, brought in its wake a fierce competition in marketing the superabundant goods.

The price of gasoline fell as low as 32 sen per gallon, whereupon the six leading companies—namely, the Nippon Oil, the Ogura, the Mitsubishi, the Mitsui, the Rising Sun and the Socony-Vacuum—adopted in July, 1932, a new agreement designed to regulate not only prices, but also the quantity to be marketed. The formation of this sort of cartel had the result of sending up the price of gasoline to as high as 49 sen. This called forth strong protests from the taxi-cab people. With a view to obviating such a clash of interests between producers and consumers, the Government, in November, 1932, brought within the scope of the Major Industries Control Law the production and distribution of gasoline by such companies as had a turnover exceeding a monthly average of 10,000 barrels.

With the application of this law, the autonomous regulation of the petroleum business seemed to gain in effectiveness. At this juncture, however, Mr. Matsukata began importing Russian oil, causing a breakdown of the cartel. The arrival in August, 1933, of the initial importation of 10,000 tons of Russian oil by Mr. Matsukata's Japan-Soviet Oil Company (popularly known in Japan as "Nisso") caused a general fall in the market price of gasoline until it again reached 32 sen, at which level it scarcely covered costs. The marketing cartel, even when backed by the Industries Control Law, proved unable to meet the outside competition.

Effects of the New Law

But this situation hastened the Petroleum Industry Law, which came into force in the spring of 1934. Just prior to this, the "Nisso" was induced to subscribe to the marketing agreement, so that the cartel membership now included seven Japanese companies. This agreement fixed the ratio of foreign and domestic oils to be placed on the market at six to four. The Petroleum Industry Law provides that the ratio be fixed by the Ministry of Commerce and Industry, taking into account the conditions of supply and consumption in preceding years, and for the second half of 1934 the ratio was fixed at five to five.

Thus, in accordance with the principle of safeguarding domestic industries, the Japanese companies were awarded an increase in the allotment in respect of the estimated increase in demand. In view of the Government's intervention under the Petroleum Industry Law in the matter of fixing quotas for the importation and marketing of oil products, the private companies' cartel came to concern itself merely with auxiliary questions, such as fixing and enforcing wholesale prices, and, indeed, the control of the market under the P.I.L. was so effective that even when subsequently the term of the private agreement expired, no evils such as dumping were experienced.

About this time the Nippon Oil, the Mitsubishi and the Ogura formed the Domestic Gasoline Producers' Association under Article 1 of the Industries Control Law, and made an agreement regulating the price and quantity to be put on the market. Then three other Japanese companies, the Aikoku, the Hayayama and the "Nisso," joined the Federation. Attempts were made to bring in the two foreign companies also, but this plan did not materialize.

Japan is now making belated efforts to set up a national oil policy. But owing to lack of funds on the part of the Government and the pressure of foreign capital in the field, Japan's oil industry has, so far, remained without any definite guiding principles.

Although the new P.I.L. has been made light of as being no more than a mere imitation of foreign legislation and has, as a matter of fact, shown itself defective in many respects, it marks, without doubt, a step in the right direction for Japan. Both the importation and refining of petroleum have been placed under direct Governmental supervision and control, a prelude to the setting up of a national policy for the industry. But it seems likely that the presence of influential foreign interests may render a thorough application of the new law somewhat difficult.

The Storage Problem

Another major problem of the Japanese oil industry is that arising from the storage provisions of the Petroleum Industry Law. According to this law all companies must have in storage a quantity of oil equivalent to six months' requirements by the end of June, 1936, and while the Japanese companies have already in store this quantity the foreign companies have not as yet installed the necessary equipment for storing the second half of the prescribed amount. The Government on their part have made an appropriation in the Budget to the amount of Y.2,700,000 for the purpose of indemnifying the various companies for the loss and expenses incurred in connection with the storing of petroleum.

The main point at issue seems to lie in the provisions for an obligatory storing of petroleum, with which the foreign companies are reluctant to comply. Here one cannot proceed too cautiously, but strong measures would seem necessary to regulate the importation of petroleum and to protect the domestic refining industry.

While it goes without saying that the rights and privileges enjoyed by foreign concerns must be honored and protected, it is equally important for Japan that ways be found to afford domestic industries a wider field of activity.

For instance, any increase in demand for oil products will not unnaturally be allotted to such Japanese companies as do not practise production curtailment. It would be well to remember that in various countries control of the oil industry is not undertaken solely from economic considerations. The attempts of Great Britain to attain self-sufficiency in oil supplies, for example, are not just economically inspired. Such efforts are directed by considerations of national defence, and herein lies the supreme importance of oil industry control.

The United States, with her superabundant supply of petroleum, is chiefly concerned with the problem of restricting production, but most other countries, including Japan, must make self-sufficiency the ultimate objective of their oil policy quite apart from economic considerations. The efforts of the nation will be directed towards the acquisition and development of oilfields and the production of substitute oil fuel, and the presence of the foreign companies is rather against this. Between 1900 and 1907 an extensive exploration of Japanese oilfields was made by an international company formed by the Standard interests, which revealed that the reserves of petroleum therein cannot be compared with, say, those in Oklahoma or in the Baku district of Russia.

Nevertheless, the meagreness of the domestic production must be due in part to the fact that, laboring under the pressure of foreign oil, the Japanese companies have been unable or unwilling to develop home resources. Indeed, drilling was for many years mostly perfunctory, development of domestic supplies being undertaken almost exclusively by the Nippon Oil Company. More recently, however, the Nippon Mining Company came upon the scene, and in Formosa, Karafuto and Akita these two companies are now vieing with each other in drilling works. As a result, their combined production at Yatsuhashi and Okuni, in Akita, reaches the daily average of over 2,000 tons.

Japanese Companies in Foreign Fields

Among foreign fields worked by Japanese companies may be mentioned those in Dutch Borneo, under the joint operation of the Nippon Oil Company and Mitsui, and the concessions obtained in Russian Sakhalin, extending to 1,000 square miles (Russian). The investment by the two companies in the Borneo field amounts to Y.3,000,000, but the result of the drilling was merely the jetting forth of gaseous substances, so that at present operations have been suspended. As for the work in Russian Sakhalin, notwithstanding the pressure exerted by the Soviet authorities, the operation has been more encouraging and has yielded the following results :—

Japanese Output in Russian Sakhalin

	Metric Tons
1926 (the first year)	34,400
1927	77.100
1928	122,700
1929	184,100
1930	192,300
1931	186,800
1932	186,700
1933	192,900

In addition to the oil it thus produced, the North Karafuto Oil Company has been making purchases of Russian crude and importing it to Japan during the summer months. The amounts of these purchases and the imports are as follows :—

	Amount Purchased Yen	*Imports of Oil Produced or by Purchases* Metric tons*
1926	—	13,909
1927	—	44,900
1928	—	90,300
1929	27,700	131,500
1930	37,300	199,000
1931	112,500	272,700
1932	135,000	313,500
1933	124,700	313,200

It may be added that, in view of the fact that the term for the prospecting drilling in the fields under the concession expires in 1936, the company is concentrating its efforts on prospecting.

Oil Fields in Manchoukuo

Turning to the exploitation of oil resources in Manchoukuo, February, 1934, saw the establishment of the Manchuria Oil Company, with a capital of Y.5,000,000, all paid up, contributed by the Manchoukuo Government (Y.1,000,000), the South Manchuria Railway (Y.2,000,000), the Mitsui, Mitsubishi, the Nippon Oil and the Kokura (Y.500,000 each). Prospecting drilling by the new company is at present being undertaken along Chalainoer. Prior to the establishment of this company, the rôle played by Japanese oil companies in Manchuria was quite insignificant, the major part of the demand being met, apart from the Russian oil imported by way of Vladivostok, by the three companies representing British and American interests.

These foreign supplies covered 90 per cent of the total demand in Manchuria. In the circumstances, the effects of the Oil Monopoly Law, promulgated by the Government of Manchoukuo on November 14, 1934, and put into effect on April 10, 1935, was most keenly felt by foreign oil. Meanwhile the Manchuria Oil Company is making somewhat slow progress, and the monthly quantity of crude oil refined by the company is limited to 5,000 tons, which corresponds to about one-third the total demand in Manchoukuo, the remainder being taken care of by foreign imports and by the products from shale at Fushun. However, the Manchuria Oil Company and the oil industry of the South Manchuria Railway Company are slowly but steadily gaining in importance in the petroleum development program of Japan and Manchoukuo.

So much for the oil resources available abroad. For a country like Japan, with but scanty domestic supplies, the work of extracting liquid fuel from coal by distillation and liquefaction processes is of great importance. Fortunately, both Japan and Manchoukuo have fairly abundant coal resources, and the imperative need for both countries is to build up the oil industry by utilizing these resources. The difficulty lies in the fact that relatively expensive coal must be used, so that it is difficult for the product to compete with well oil. However, it is encouraging to note that the Mitsubishi Mining Company is making efforts in this direction, and a cheerful aspect of the liquefaction industry is that its by-products, in the shape of dyestuffs and other chemicals, tends to reduce production costs considerably.

Oil from Coal

It may be noted, too, that in Germany, although the new process was technically brought to perfection more than a decade ago, the scheme has been put into practice only since that country has found itself short of supplies. From this, it is sometimes deduced that the utilization of this source of oil supply, entailing as it does no small cost, has little to commend itself. Generally speaking, from four to five tons of coal are required in order to produce one ton of oil.

On that basis something like 8,000,000 to 100,000,000 tons of coal, i.e., a quarter of Japan's present total consumption, would be necessary for the manufacture of the 2,000,000 tons of oil which constitutes the annual domestic demand. All that can be hoped for is that by increased technical skill the extraction of oil from coal will one day attain the dignity of a paying industry.

Funds for the National Policy

The funds required for the expenditure to be incurred by this national oil policy will, it is understood, be provided by increasing the import duty on petroleum. The existing Customs tariff on petroleum, including the 35 per cent additional duty of 1932, is as follows :—

	New duty. Yen per 100	*Old duty. American gallons.*
Gasoline	10.80	8.00
Heavy oil	2.29	1.70
Lubricants	9.45	7.00
Crude oils :		
Not exceeding :—		
20 per cent by vol. of gas oil	2.29	2.29
25 ,, ,, ,,	2.80	2.76
30 ,, ,, ,,	3.33	3.24
35 ,, ,, ,,	3.88	3.71
40 ,, ,, ,,	4.45	4.18
Others	5.02	4.65

Light oil and kerosene are omitted, as they are not affected by the tariff increase.

As the crude oil imported by the Japanese companies is mostly of the kind having over 40 Beaumé, the duty as revised would amount to about Y.4.50 per 100 gallons. Under the existing tariff the oil products manufactured from imported petroleum are placed somewhat at a disadvantage in comparison with the petroleum products directly imported by foreign companies. Since the Japanese oil industry is still in its infancy, a further increase of the import duty on gasoline by 15 per cent would seem to be in line with the national oil policy. [Note.—The tariff as it exists at present is slightly in favor of oil products manufactured from imported crude oil, and not, as is here stated, in favor of imported refined products.—Ed. P.T.]

The successful carrying out of these and other measures in the prosecution of this national policy will call for determined efforts on the part of the Japanese Government. From the national standpoint it seems desirable that the oil control policy should be carried out on the most economical lines and with a minimum of friction with foreign interests. But the basic need is for the development of an adequate oil industry. It is to the fulfilment of this that the concerted efforts of Japan and Manchoukuo are now being directed.

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*Part of the production is turned over to Russia under the terms of the contract.

The Japanese Tinplate Industry

According to a writer in the *Japan Times and Mail* the history of the tinplate industry in Japan may be divided into three periods: the first from 1919 to 1922, the second from 1922 to 1933, and the third from 1933 to the present. The first period might be called a period of experiments. So great were the difficulties confronting the manufacturers that every one of them had to suspend operation at some time during this period. The first attempt to manufacture tinplate in Japan was made in 1919, when the Tokyo Tinplate Manufacturing Co. began operation with a plating machine purchased from the United States. But this company only plated tin on imported blackplates, and succeeded in making only 1,000 boxes. After this the Tokyo Tinplate Co. suspended operation, being unable to make both ends meet.

In July, 1921, the Nitto Steel Works at Kawasaki engaged three German experts to manufacture tinplate. Its plant manufactured blackplates from tin bars to be plated with tin. This company, too, failed to succeed because of the economic depression of the time, and closed its plant in 1922.

Production of Government Works at Yawata

Prior to this, the Government Iron Works at Yawata had been making preparations for the manufacture of tinplate from the standpoint of national interest, regardless of the possibility of business success, realizing the importance of the industry in times of national emergency; but many things conspired to delay its realization until 1922, in which year the company purchased the necessary machinery from the United States and commenced operation in June. At about this time the Nitto Steel Works gave up its operation and so the Yawata Iron Works took over the German experts whose services were no longer needed by the former company.

At first the Yawata Iron Works were unable to succeed owing to technical difficulties and the poor quality of the materials, but the persistent efforts of the workers resulted in the plating of tin in April, 1923. Its tinplate under the brand of "Maru S" was put on the market in June of the same year.

The Yawata Iron Works struggled hard as the only Japanese producer of tinplate to compete with foreign producers during the second period of the tinplate industry, namely, from 1922 to 1933. Within several years of commencement of operation the Yawata Iron Works succeeded in manufacturing tinplate of a quality which compared favorably with that produced by Great Britain and Germany. On account of technical difficulties and the lack of a protective tariff, private enterprise could not undertake this industry; but the Government Iron Works at Yawata continued their operations with a measure of success. At any rate, the Yawata Iron Works made a notable contribution towards the progress of the tinplate industry in Japan. It was in November, 1922, that the first hot mill for plates was put into operation. After facing many difficulties in improving the quality of the product and in training technicians, the number of rolls was increased one by one, the seventh mill being installed in November, 1931. The second tinplate plant was operating ten hot mills within nine months.

American Production Methods Adopted

In the early stage of the enterprise the method used by both England and Germany in making tin bars was employed, but it was later discovered that there was a large percentage of silicon contained in tin bars thus made. From the beginning of 1927, therefore, the Iron Works have used the American method, and have succeeded in reducing the amount of silicon, thus making tin bars of a better quality. The Iron Works adopted the better rimmed steel; they also made steady improvements in the method of manufacturing tin bars from steel billets. At first the steel billets were re-heated before being reduced. But since August, 1927, the better method of manufacturing tin bars of 200 mm. direct from steel billets has been adopted. Thus materials have been improved and the cost of production has been reduced steadily. The company also succeeded in making tin bars of 250 mm., thus increasing the productive efficiency of its plants.

Fuel and Motive Power

Use of fuels also has been improved. At first only coal was used, but now both coke and coal are used to the best possible advantage. At the same time the motive power has been improved. Steam power has been replaced by electric power. The method of rolling has undergone several stages of evolution before reaching the present state. Each roll could reduce a total of four tons during each shift of eight hours in 1924, but the amount was increased to about 6½ tons in 1933. When the width of plates is 28-in. the total amount will be 7½ tons.

At first nitric acid, both black and white, was used for pickling purposes; but it has been replaced by a cheaper synthetic hydrochloric acid. Formerly an imported inhibitor was used, but it has been replaced by a domestic chemical. The company has taken steps to improve both the hot and the cold rolling processes.

Much progress has been made in the method of plating by the Yawata Iron Works. At first the Thomas method was used, then the Anderson method, and this in turn was replaced by the Abacan method. Finally, the Pool-Davis method came to be adopted, and the productive capacity has been increased from about three tons to between six and seven tons per roller per shift of eight hours.

Since the commencement of the third period of development —namely, 1933 up to the present time, the Yawata Iron Works have completed a new plant for the monthly output of 50,000 tons, and its products were placed on the market in March of the same year. Thus, when the productive capacity of the old equipment is added, the Yawata Works (now merged with the Nippon Iron Works) are capable of producing 90,000 tons. The new plant at Yawata called for an expenditure of Y.2,700,000 and covers a total area of about 24,000 sq. yds. The plant is equipped with up-to-date machinery and in scale compares favorably with the best plants in Western countries. The plant has ten mills whose capacity will shortly be increased from 500,000 tons to 540,000 tons.

The Fuso Steel Works, of Kanagawa-ku, Yokohama, began to manufacture tinplate in January, 1933. The Toyo Steel Plate Co., of Shitamatsu, began operation in February, 1935, and is equipped for the annual production of 20,000 tons, which it is intended to expand to 40,000 tons in the near future.

The rapid development of the tinplate industry in Japan within the past twelve years is only comparable with that which was recorded by the same industry in the United States during the latter part of the nineteenth century. It is all the more astonishing, inasmuch as it had no high protective tariff such as the McKinley tariff.

Japan's demand for tinplate was about 120,000 tons in 1932; it was increased to 177,000 tons in 1934. Production in 1923 was 959 tons; in 1934 it was 62,230 tons. Nevertheless, imports of tinplates, which in 1923 were 71,946 tons, amounted in 1934 to 114,506 tons.

New Rail Line in Chosen

The government of Chosen intends to build another trans-peninsular railway trunk line between Fusan and Keijo on a 10-year program, starting in the current fiscal year, subject to the approval of the coming extraordinary Diet session.

A Y.100,000,000 project, the line will extend approximately 270 miles, just about 10 miles less than the present trans-Chosen trunk line. When completed it is expected to speed up trans-Chosen traffic, which in turn will shorten the trip between Japan and Manchoukuo.

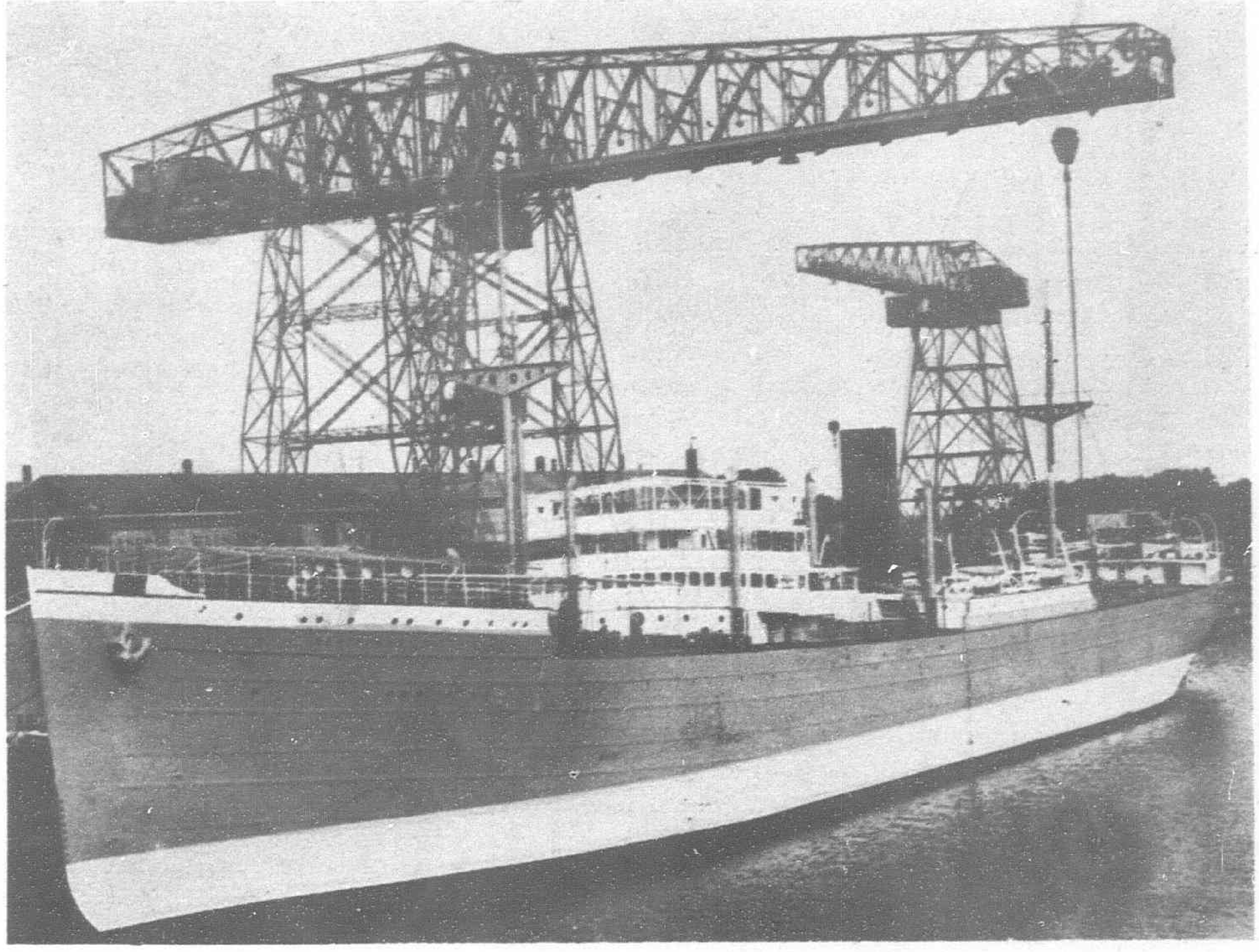
In addition, the proposed line will traverse the region least affected by seasonal floods, which is considered important from the standpoint of national defense and industrial development of the peninsula. Along the proposed route is the rich hard coal field of Neietsu, which is practically left unexploited.

The proposed line will link Fusan, Urusan, Choyoi, Keishu, Hyosen, Gijo, Tan-yo, Genshu, Yohei, and Seiryori, on the eastern outskirts of Keijo.

In view of the fact that the Government can use the private railway from Fusan to Keishu via Urusan, which it has recently bought, actual construction will begin between Keishu and Hyosen.

The Dutch Steamer "Kertosono"

Speedy Conversion to High-Pressure Service — The First Sulzer Marine Monotube Steam Generator Plant



View of the cargo boat S.S. "Kertosono" of the Rotterdam Lloyd

The cargo steamer *Kertosono*, belonging to the Rotterdam Lloyd resumed her regular service form Rotterdam to the Dutch East Indies, on March 17, 1936. The conversion of this vessel, described in detail in the following, is particularly noteworthy in that very little time was available for building-in the high-pressure steam plant and for changing over to high-pressure working.

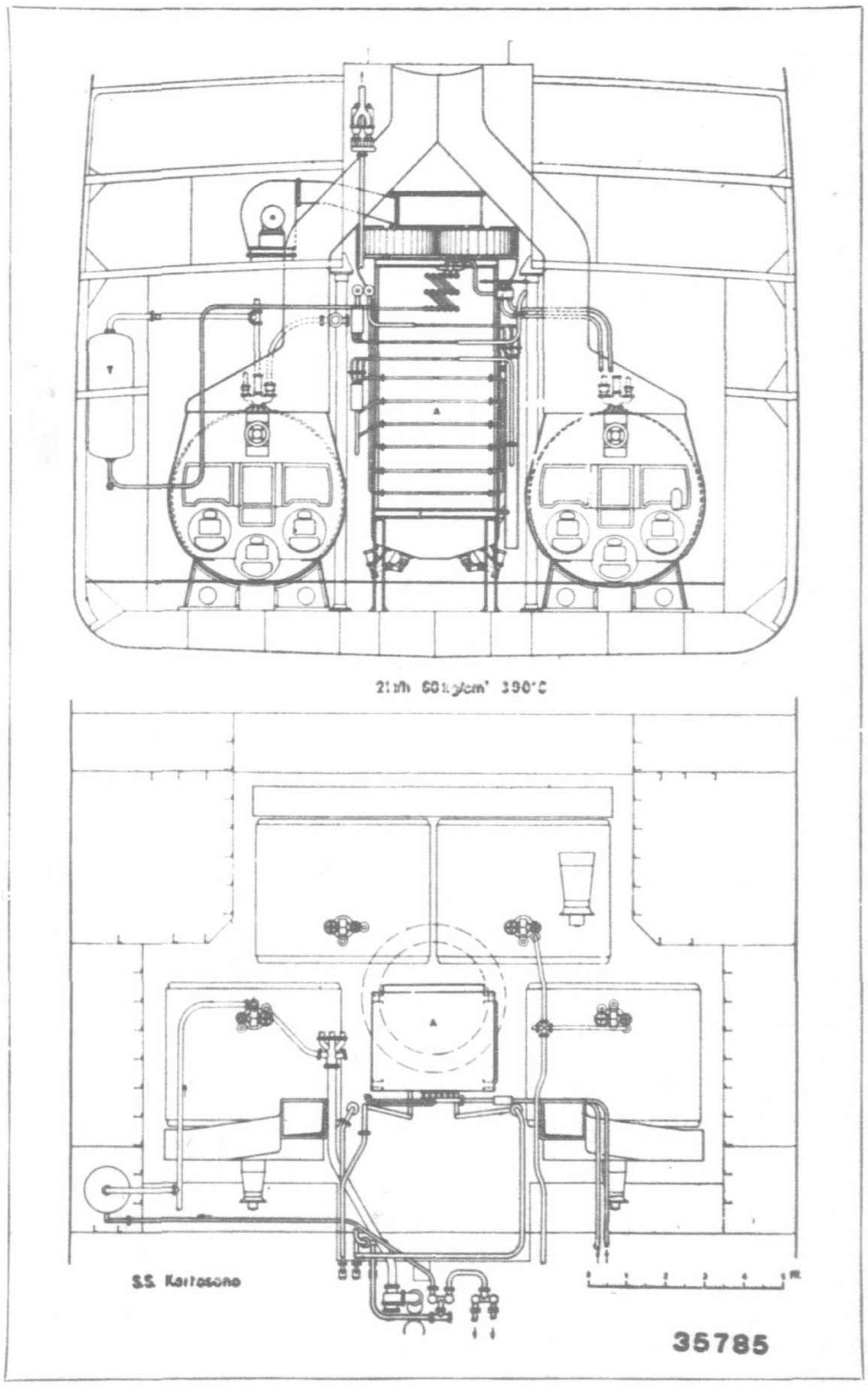
In consequence of bad weather the *Kertosono* did not arrive at Flushing until February 16, so that the whole work of conversion, which was terminated by March 6, had to be carried out in the "De Schelde" yards in just under three weeks.

Although the tests and trial runs which were intended to follow could not be carried out according to program because of fog, the official trial run took place on March 11, in the presence of a number of invited guests. On March 14, the vessel could be dispatched to Rotterdam to be put again into regular service. From March 18 to 21, the *Kertosono* was at Antwerp to take in cargo. The run from Rotterdam to Antwerp gave ample opportunity to demonstrate the ease with which the Sulzer high-pressure monotube steam generator could be handled, and the plant proved highly satisfactory in every respect.

The combined automatic regulating gear, through which the regulation of the monotube steam generator and also of the turbine is controlled by means of a single handwheel, facilitates manoeuvring considerably, since the arrangement of the regulating gear is centralized and thereby much simplified in comparison with the low-pressure plant. Each manoeuvre could be carried out without trouble; for example, manoeuvring from "full speed ahead" to "full speed astern" could be effected in fifteen-twenty seconds.

At the trials in the shipyard at Flushing the guarantees of the steam generator were absolutely fulfilled; efficiencies up to 94 per cent were measured, so that between half and full load, including the auxiliary machines, an efficiency of over 90 per cent resulted.

All auxiliary machines in connection with the high-pressure monotube steam generator proved to be capable of fulfilling the stipulated requirements. The change-over to the stand-by units, for example to the stand-by feed pump, could be carried out with the greatest ease. Also the condition that any one of the four burners could be replaced when the boiler was in full service, the other three burners then temporarily and automatically taking the full load, could be easily fulfilled.



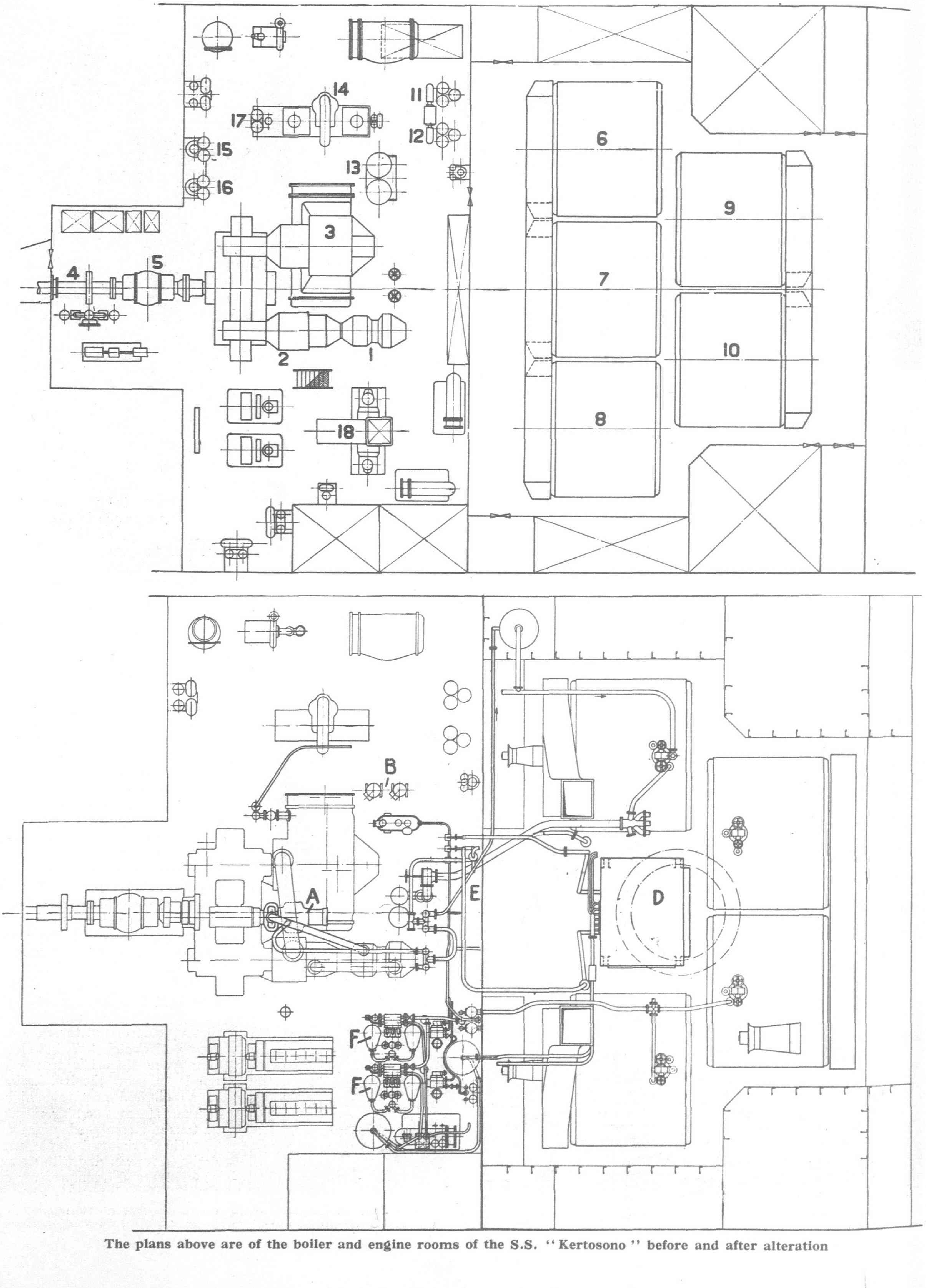
Arrangement of high-pressure monotube steam generator between the existing Scotch boilers on the "Kertosono"

In the plant any desired kind of fuel may be burnt. For the first voyage a special heavy oil with a specific gravity of 0.996 was used. At all loads, and also under all conditions of load fluctuation, the combustion is absolutely smokeless, thanks to the automatic regulation of the stoker.

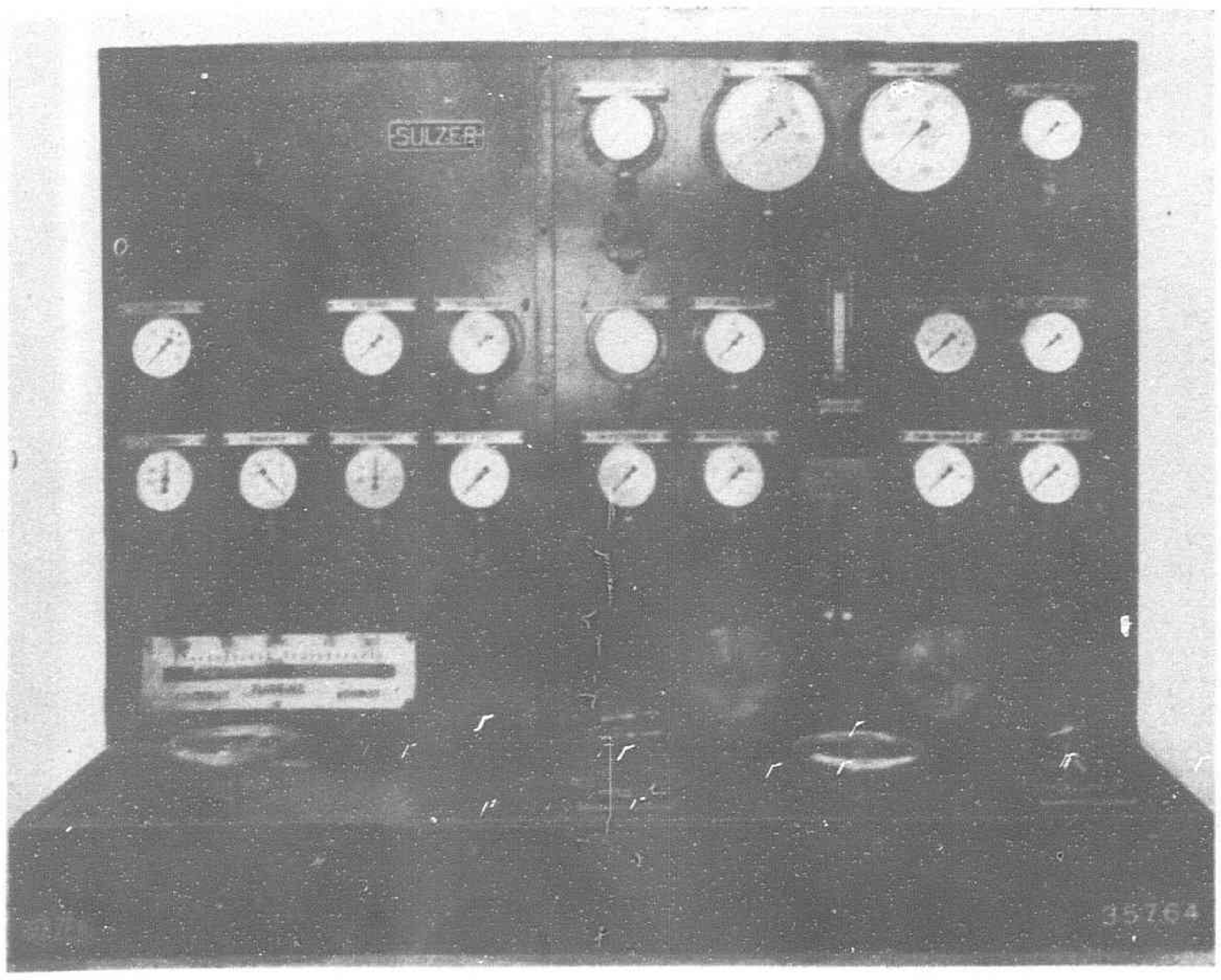
When planning the conversion of this steamer of 16,500 tons, which was built in 1922 by the Kon. Jij. "De Schelde" at Flushing, the problem set was to install a high-pressure boiler, at first for experimental purposes, in order to increase the output and thereby give the ship a greater speed, i.e. fifteen knots instead of thirteen.

It was found sufficient to remove only one of the existing six tons "Scotch boilers," since the space thus left free was ample to allow the installation of an oil-fired monotube high-pressure steam generator, raising 21 tons of steam per hour.

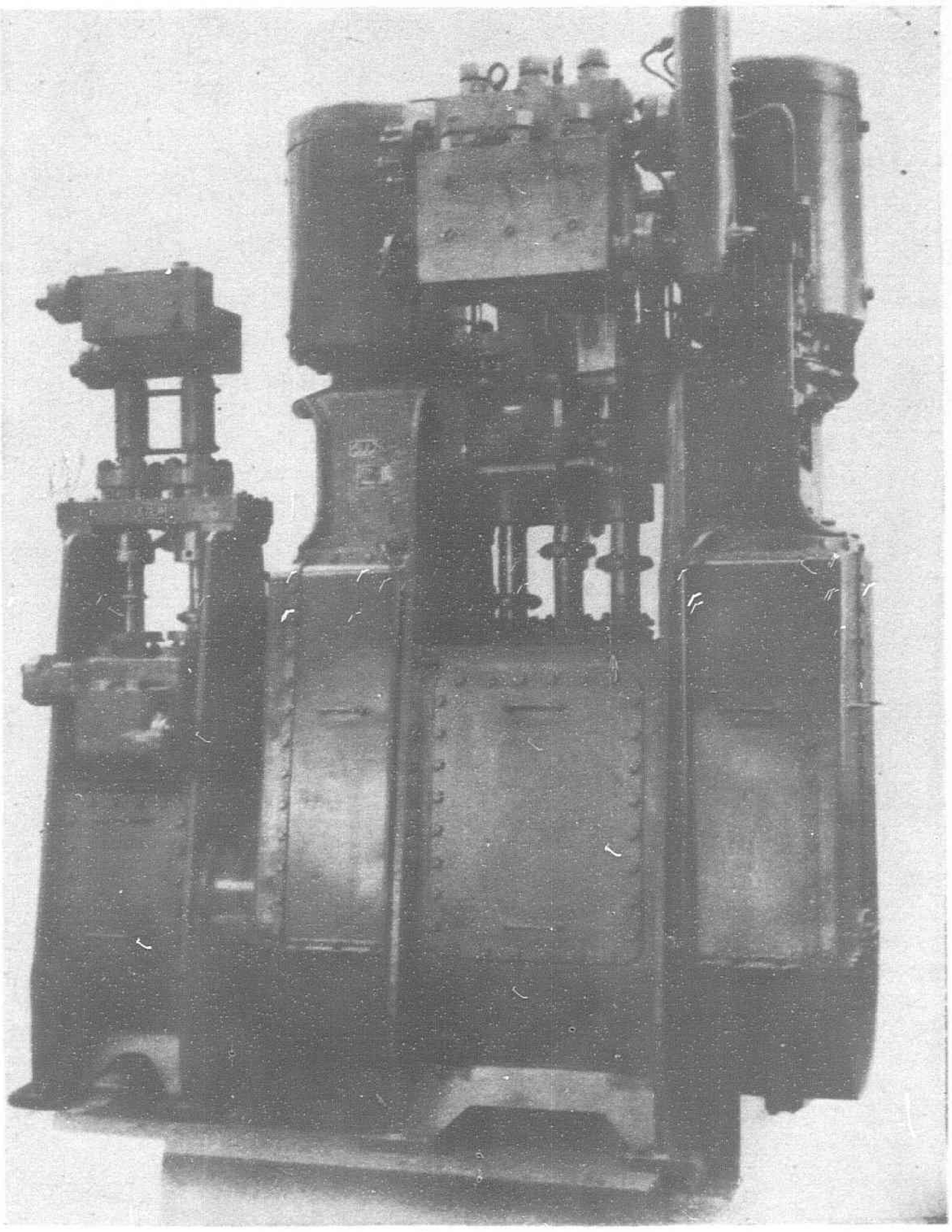
The primary plant was designed for working with steam at 60 atm. and a temperature of 375° C. In this way the output could be raised from 4,500 to 5,800-6,000 S.H.P. and the



The plans above are of the boiler and engine rooms of the S.S. "Kertosono" before and after alteration



Control platform for high-pressure boiler and turbine on S.S. "Kertosono"



Steam driven feed water, feed oil and regulating oil pump for S.S. "Kertosono"

number of revolutions of the propeller from 90 to about 100 p.m. For this purpose a high-pressure back-pressure turbine has been installed to act as primary turbine to the existing turbine, on which only minor alterations (to the blading) had to be made. The plant is arranged in such a way that it is possible in an emergency to work direct with low-pressure steam from the remaining four low-pressure boilers.

The arrangement of the new high-pressure steam generator in the boiler room can be seen from an accompanying illustration. The monotube steam generator is in the middle, with two of the existing low-pressure boilers on each side. Above, to the left, the blower is arranged, which supplies combustion air to the combustion chamber through an air preheater.

Another illustration shows details of the manoeuvring platform. From here, by means of a single handwheel, the whole plant, including the ahead and astern turbines as well as the auxiliary apparatus of the steam generator, can be controlled. On the right-hand side are the instruments and service handwheel for the boiler, on the left the instruments and handwheel for the turbine.

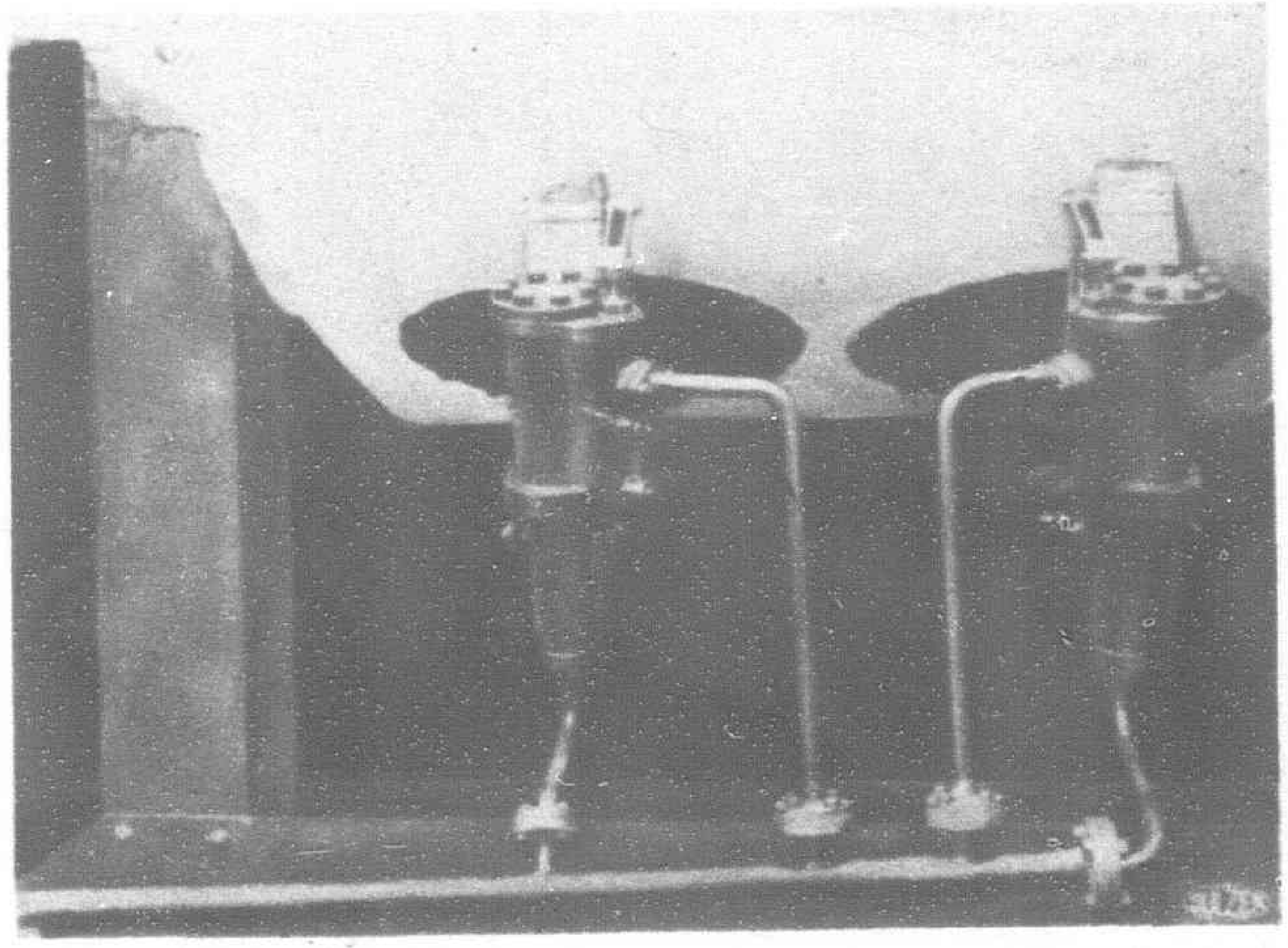
The right-hand instrument panel carries, in addition to the pressure gauges and temperature indicators, a number of gauges showing the feed-water pressure and the oil pressure in the various parts of the regulating system and also the conditions in the by-pass piping, thus allowing the whole system to be easily controlled.

The middle handwheel serves only for adjusting to the minimum quantity of steam in the position "Ready for Service."

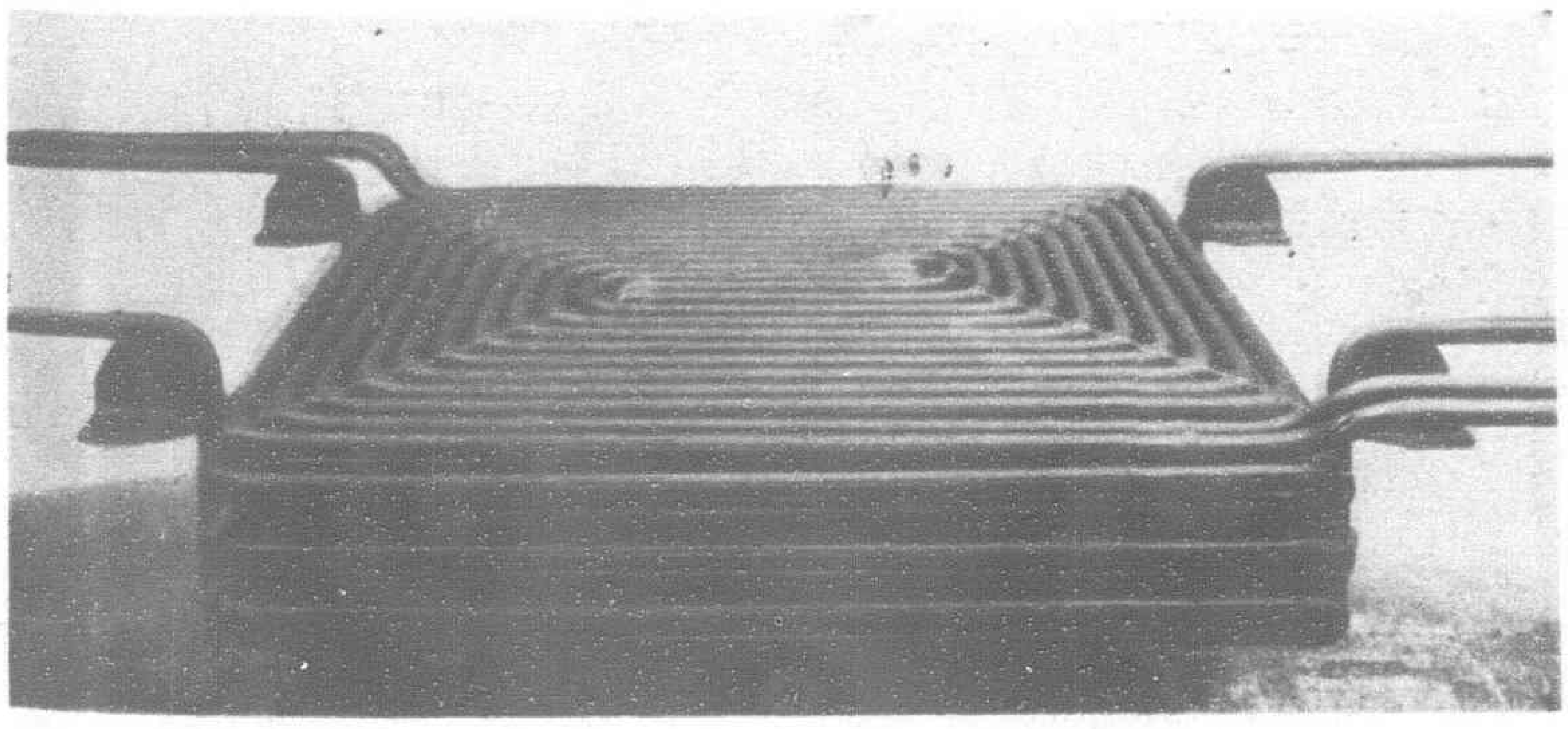
The air pressure at any moment, or the difference of air pressure in the burner, can be read from the indicator situated above it.

With the handwheel to the left, i.e. on the turbine side of the manoeuvring platform, the whole plant is controlled, as already mentioned. The position of the indicator on the horizontal scale arranged above the handwheel shows the conditions of working of the turbine at any moment.

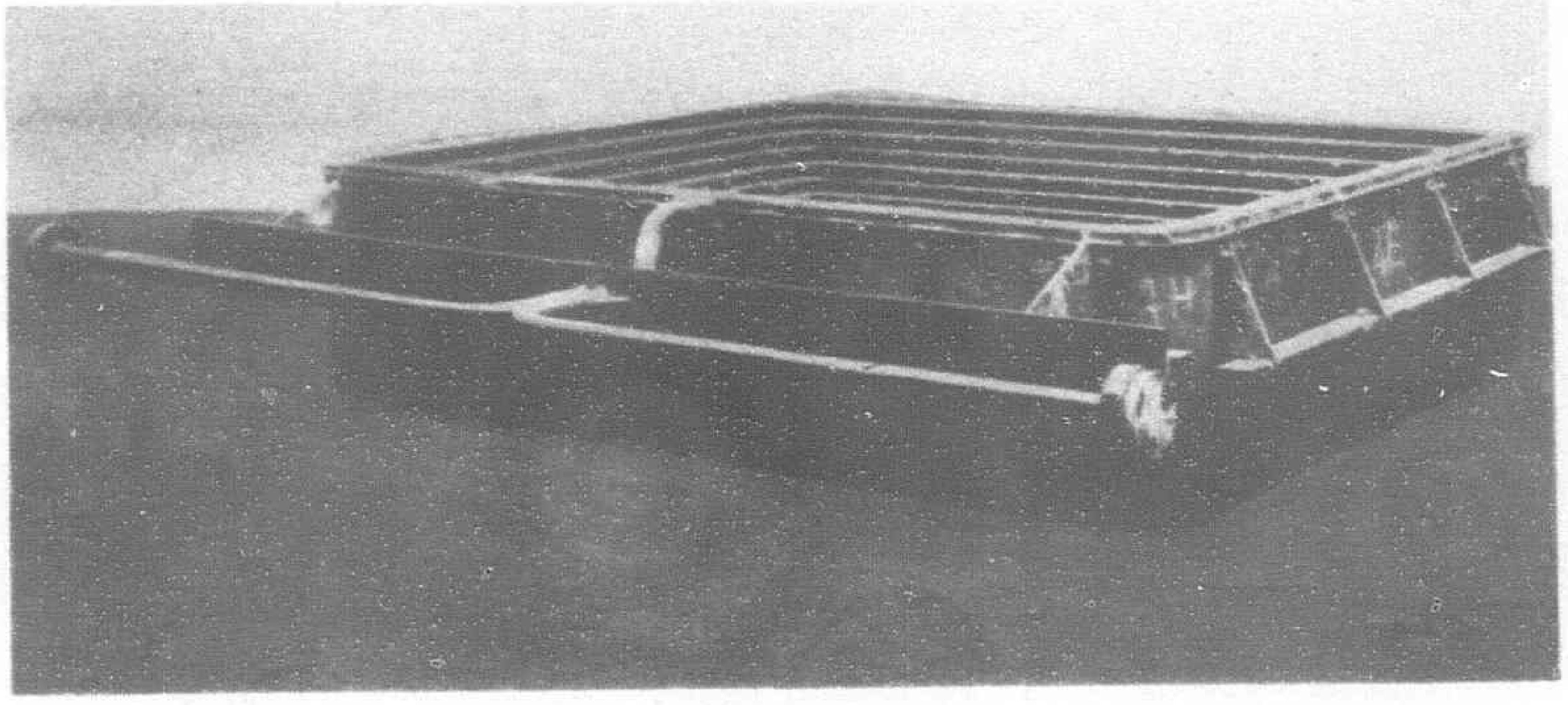
The instruments arranged above it show the pressures before and after the high-pressure part, also in the medium-pressure part and in the condenser.



Arrangement of automatically controlled burner adjusting device in bottom of boiler on S.S. "Kertosono"



Tube coil of oil-field monotube steam generator



High-pressure monotube steam generator of S.S. "Kertosono," combustion chamber lining. Element of 7.5 m2 heating surface

In the space above which still remains free, a speed indicator is fitted, from which the speed of the propeller at any moment can be seen.

When the plant is "Ready for Service," it is only necessary to turn the turbine control handwheel either clockwise or counter-clockwise, according to the direction in which the vessel must move. The whole regulating system is arranged in such a way that the control of the burners (i.e. of the quantity of fuel, the quantity and pressure of the air) on the one hand and also the control of the turbine valves and of the quantity of feed-water (i.e. the speed of the steam-driven feed-water pump) can be effected automatically from this central position. In this way the pressure and temperature of the steam can be kept practically constant, even when manoeuvring quickly.

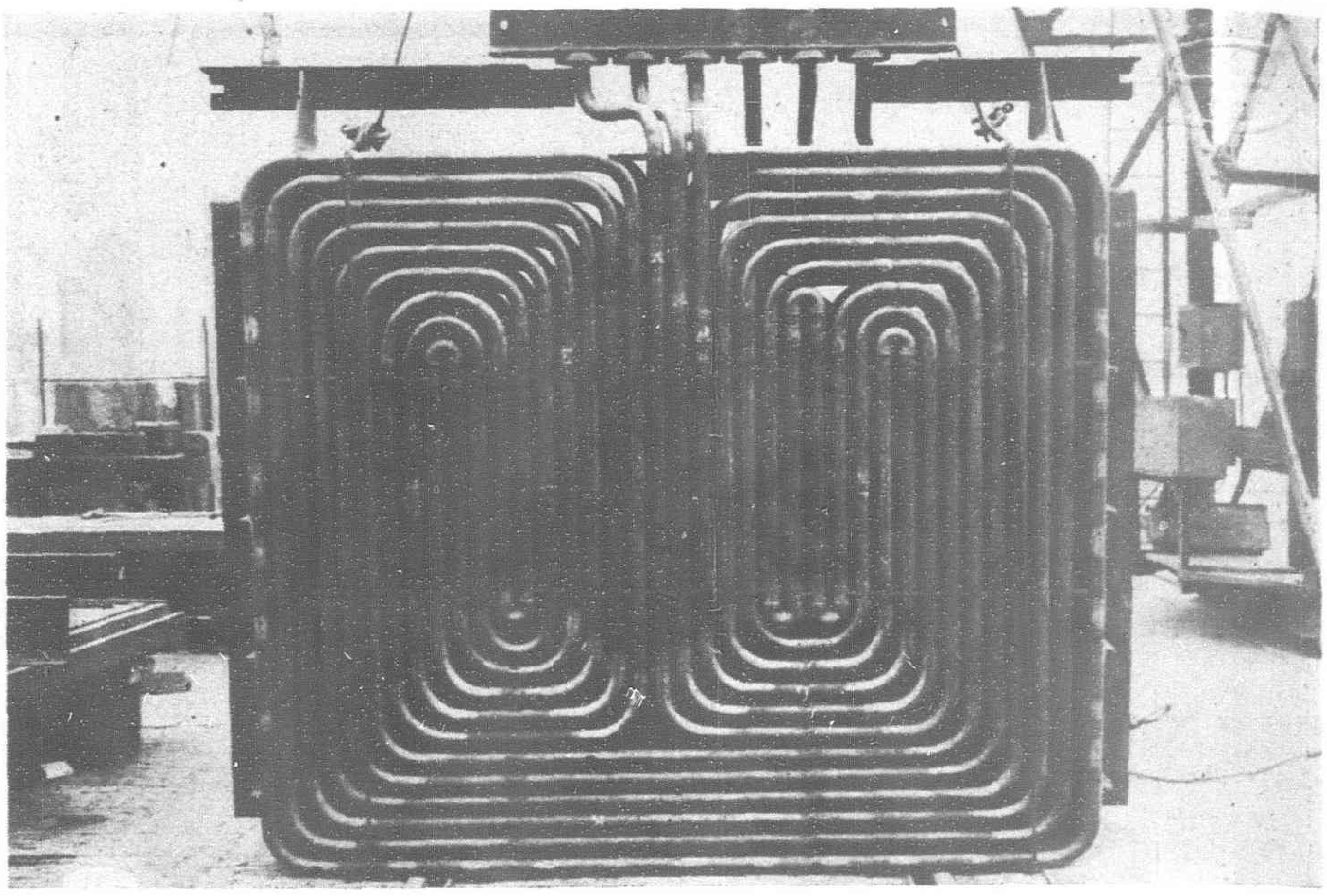
This is of course only possible by the provision, in addition to the positive parallel working of the feed-water and fuel systems, of an additional automatic regulation which receives its impulse from thermostats and takes over the necessary fine regulation.

The control board contains all the instruments and handwheels which are usually distributed among different parts of a plant, feed-water valve, steam valve of the pumping set, devices for controlling the burners and air pressure, etc.

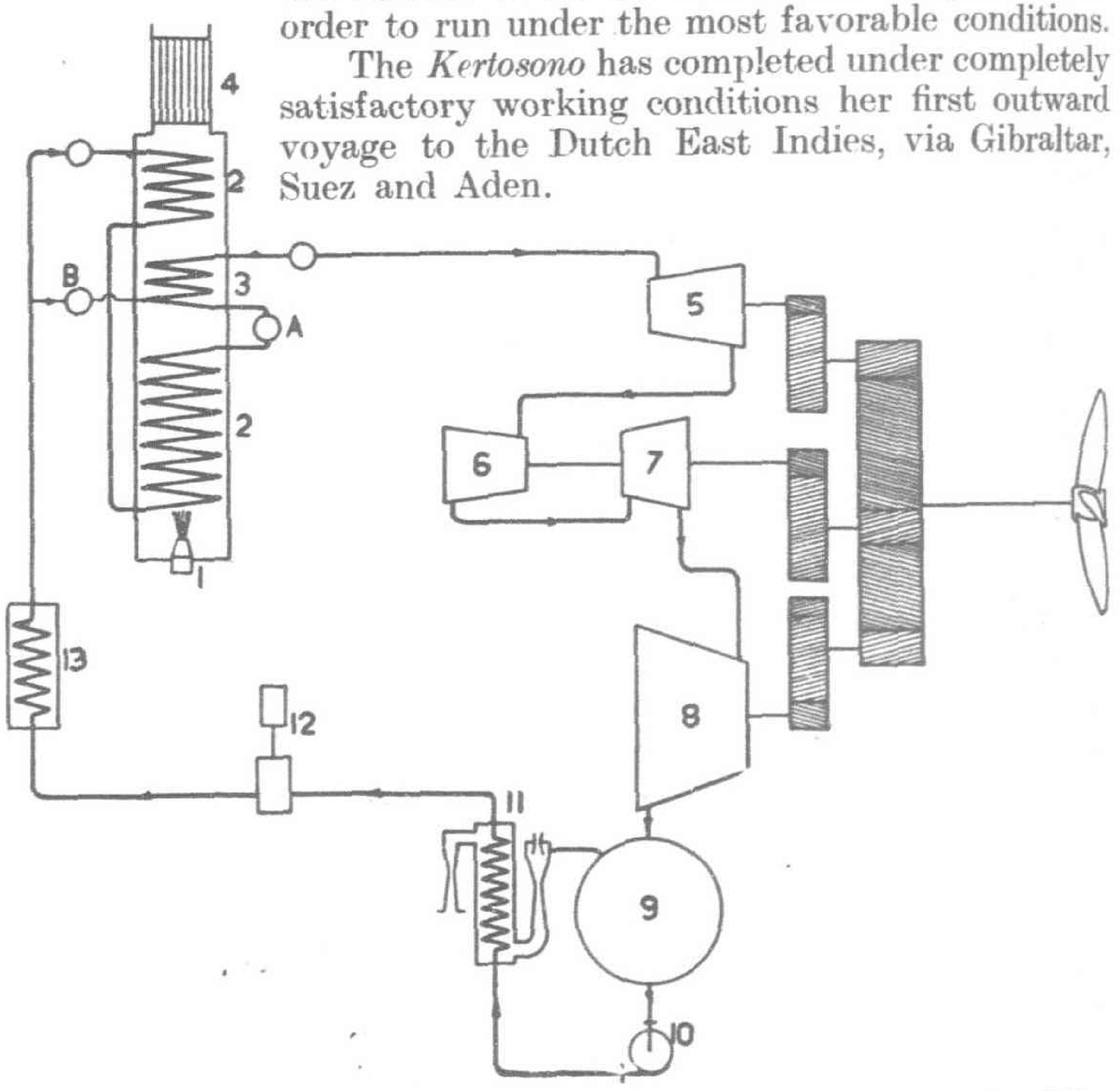
Consequently, by adopting the oil pressure regulating system, the whole control and attendance is not only centralized and thereby simplified, but the total number of instruments and handwheels requiring attention is considerably reduced.

The two adjusting screws to the right and to the left of the boiler-control handwheel serve for adjusting the temperature and pressure of the steam. Consequently, the pressure and, above all, the temperature can be modified during service. This may be particularly important in a marine plant, since, as is well known, it is advantageous when manoeuvring to work with a steam temperature which is not too high, in order that the blades of the turbine may not become overheated. When the vessel is proceeding normally at sea, the turbine works with live-steam temperature in order to run under the most favorable conditions.

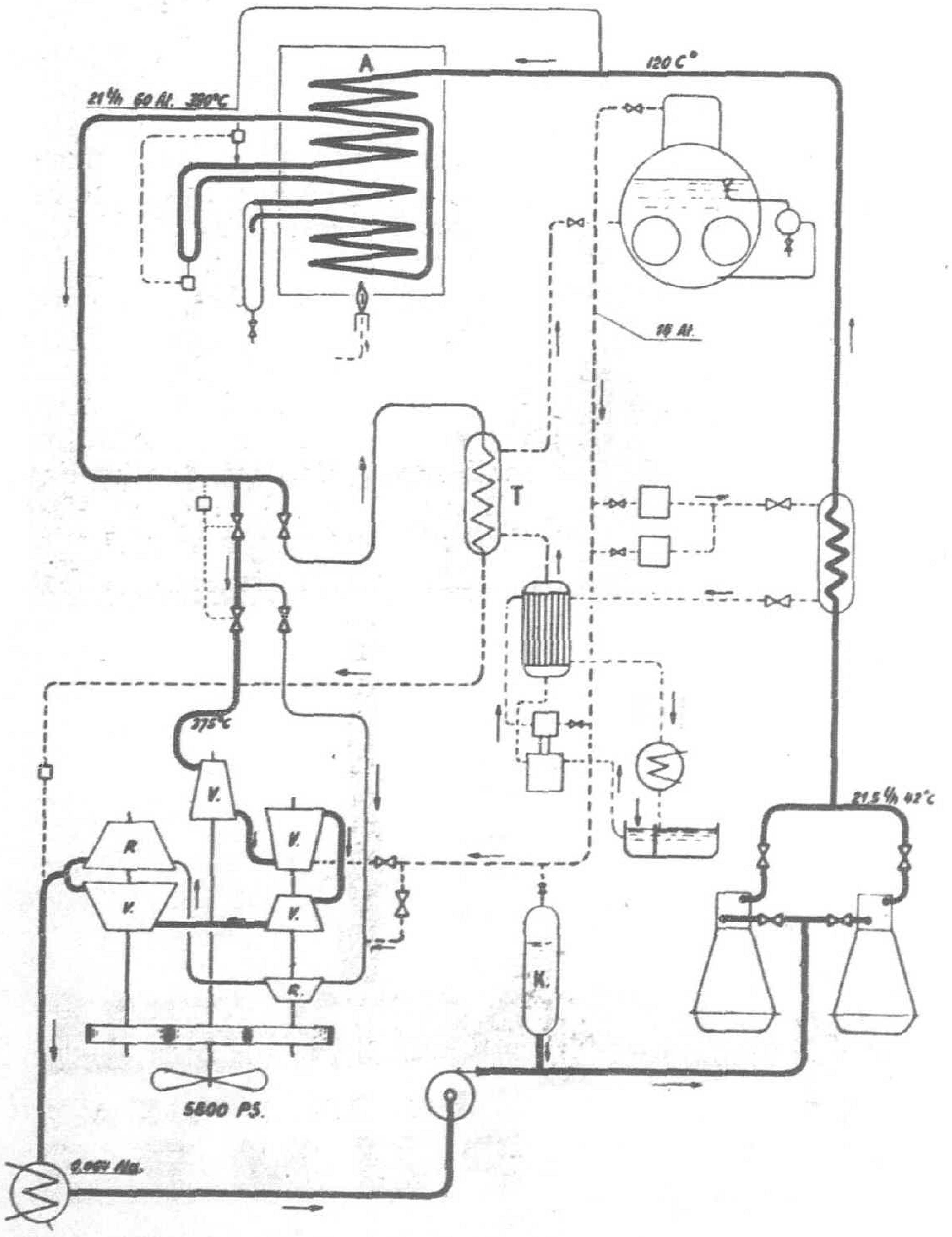
The *Kertosono* has completed under completely satisfactory working conditions her first outward voyage to the Dutch East Indies, via Gibraltar, Suez and Aden.



Monotube steam generator of S.S. "Kertosono." Economiser coil of 75 m2 heating surface



Simplified working diagram of high-pressure plant of the S.S. "Kertosono"



Working diagram of the complete high-pressure primary plant of the S.S. "Kertosono"

New Tokyo Undergrounds

Construction of the Shibuya-Shimbashi subway of the Tokyo Rapid Transit Co. has commenced, and the line is expected to be ready for traffic by the autumn of 1937. The section between Miyamasuzaka and Shibuya station will be an elevated line with its terminal connecting with the third floor of the department store operated by the Tokyo-Yokohama Electric Railway Company. Another subway, connecting Shinjuku and Yotsuya-mitsuke, is included in plans for the first construction period, but details have not yet been arranged. In the second period of construction, the company proposes to extend the Shinjuku-Yotsuyamitsuke line to Tsukiji. Other projected lines will connect Tokyo station with Meguro, Ikebukuro and Minami Senju. The Tokyo Subway Company, which operates the present line between Asakusa and Shimbashi, has already started construction on an extension to Gotanda station.

Engineering Notes

INDUSTRIAL

MANCHOUKUO SUGAR DEVELOPMENT.—Plans for the formation of a huge sugar manufacturing company, whereby Japanese industrialists would secure control of the trade in Manchoukuo, have been announced in Tokyo. The firm is to be capitalized at Y.10,000,000.

ORDERS FOR JAPAN.—The *Jiji Shimpo* reports that Japanese manufacturers have received orders from the Soviet to manufacture 500 silk-spinning machines, in addition to a large number of power-looms, while orders have been received from Siam for the manufacture of silk spinning machines.

CONSTRUCTION OF SEA-WALL.—Messrs. Gammon (Malaya), Ltd., of Singapore, have got the contract for the construction of a sea-wall at Bagan Luar, Prai. This new sea-wall is to run alongside the existing groyne at the mouth of the Prai river, the object being to secure a scour which will prevent silting.

MANCHOUKUO LUMBER.—Daido Lumbering Company, which will control the lumbering industry in Manchoukuo, is to be organized with a capital of Y.5,000,000, half subscribed by the Manchoukuo Government and the remainder by the South Manchuria Railway Company, Oriental Development Company, and Oji Paper Manufacturing Company.

NEW INDUSTRIES IN SIAM.—The Siamese Government has expressed its willingness to forward the manufacture of paper in Siam by taking a large share of the capital. Tenders were invited some time ago for the erection of a mill, and it is anticipated that from signing of the contract to the putting of the product on the market a period of two years may elapse.

BREWERY FOR MUKDEN.—Permission having been obtained from the Manchoukuo Government, a beer-brewing concern, to be called the Asia Beer Co., will soon be established in Mukden. Construction of plant, to cost Y.600,000, is due to start with the spring thaw, and it is hoped that production will commence within the year. The capital of the new concern will be $2,000,000.

LARGEST BUILDING IN JAPAN.—At the beginning of the next fiscal year the Japanese Government starts construction work on the new Communications Ministry building at the present site of the Imperial Diet building. The new building will be the largest in Japan, with a total floor area of 22,500 *tsubo*. The building will be eight-storied. The construction cost is Y.9,300,000. Work will be finished in 1940.

A MOVABLE DAM.—One of China's biggest engineering feats, to lead the Huai River into the sea by a movable dam at Sharho district, is under construction. With 1,300 laborers, the construction of the dam, which will be 750 meters long and 130 meters wide, is to be completed by the end of this year. The dam will have sixty sluices, which can be opened or closed as required by circumstances. The function of the dam is to regulate the inflow of water from Hungtseh Lake in Central Kiangsu into the Huai River, as well as to control the flow of water in the lower stream of the Grand Canal.

ALUMINIUM PLANTS.—For the past year and a half Japan Soda Company has been conducting experiments in aluminium manufacture and has succeeded in making 99.7 per cent pure aluminium on a commercial basis. It is now announced that a factory will be built at a cost of Y.3,000,000, including equipment. The annual capacity will be something like 3,000 tons, and manufacture will start in July of this year. Bauxite will be imported from India for the time being, but later the company hopes to use bauxite from Ponape, one of Japan's mandated islands in the South Sea.

WATERWORKS IN CHINA.—Hunan Provincial Government has decided to build a waterworks in Changsha, the provincial capital, in accord with plans prepared by the Department of Reconstruction. Following protracted negotiations between the Shanghai Waterworks Company and the Bureau of Public Utilities for a water supply for the extra-Settlement, Western District, conclusion of an agreement is expected. It has been agreed that a Sino-British waterworks company for the Western District shall be formed, with an initial capital of $3,000,000, the City Government of Shanghai to grant a franchise.

LIQUID FUEL.—Coal liquefaction by means of hydrogenation is expected to be developed commercially this year by the South Manchuria Railway Co., the Japan Electric Industry Co. and the Mitsui Mining Co., South Manchuria Railway, has decided to build a plant for the Navy at Fushun which will turn out 20,000 tons of gasoline a year. Japan Electric Industry is said to be contemplating equipment which will produce 10,000 tons a year. This plant would be erected in Saghalien, in co-operation with the North Saghalien Coal Mining Co. It is also reported that the Mitsui Mining Co. is planning erection of a Y.12,000,000 plant to turn out 25,000 metric tons of gasoline a year. It would probably erect its factory in the middle of the North Kyushu coal field.

SHIPPING

LIGHTHOUSES.—Negotiations are being conducted by the Newchwang Navigation Bureau with shipping concerns for the erection of lighthouses in the Bay of Pechihli.

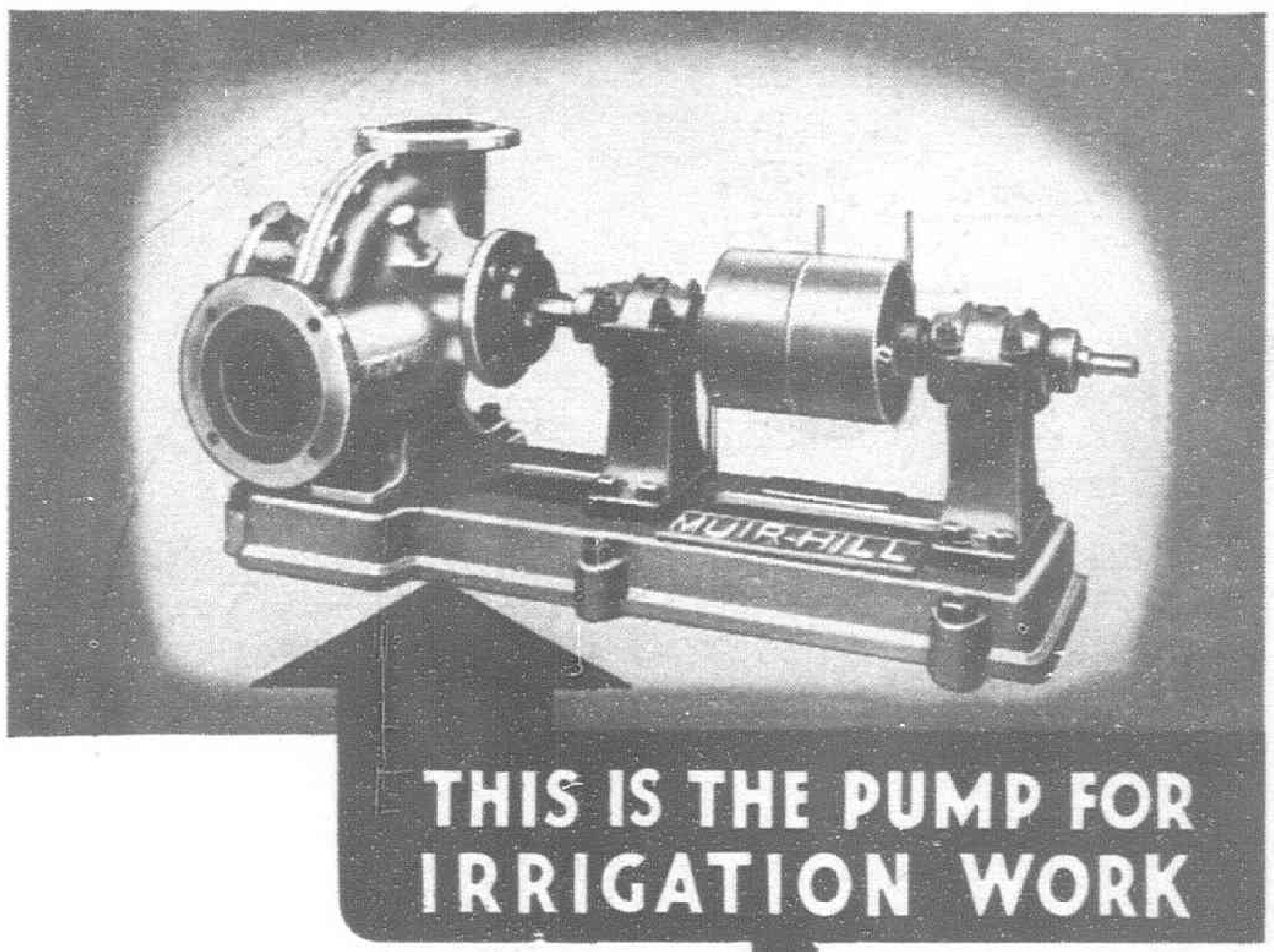
YANGTZE NAVIGATION.—In view of the great menace to navigation of the rocks at Kung Ling Tan, another order has been issued by Gen. Chiang Kai-shek to the Customs Administration, instructing that immediate steps be taken to remove these obstacles.

CHINKIANG HARBOR.—Mr. Chow Shan-chien, an engineer of the Yangtze River Conservancy Commission, has arrived at Chinkiang, at the request of the Kiangsu Provincial Department of Reconstruction, to make a survey for the improvement of Chinkiang harbor.

SOVIET ORDERS TRAWLERS.—The Soviet Trade Representation, Tokyo, has placed orders with Kuranake Shoten, Shimonoseki, for construction of about sixteen trawlers, worth about Y.1,000,000. Of these orders, six trawlers are 130 tons each and the remaining ten trawlers are 70 tons.

WHAMPOA HARBOR SCHEME.—Ambitious plans are being pushed forward by the Kwangtung authorities to develop Whampoa, south-west of Canton, into a deep-water harbor. Dr. Lo Wen-kan, formerly Minister of Foreign Affairs, and now director of the Whampoa Harbor Development Board, has approached the Central authorities for financial assistance.

BRIDGE OVER WHANGPOO.—The question of financing construction of the $12,000,000 steel bridge over the Whangpoo at Shanghai is reported to have been settled in an agreement reached by the City Government of Greater Shanghai and a group of French industrialists and financiers. Construction is now likely to begin before the end of this year. No details of the proposed bridge have yet been made public.



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RAILWAYS

RAILWAY TO SINKIANG.—A proposal for a railway connecting Sinkiang with China Proper has been submitted to the Chinese Government, which is reported to favor the project. Mr. Irving C. Yew, a Chinese engineer who accompanied Dr. Sven Hedin to Sinkiang, confirms the report that Soviet Russia has no intention of sovietizing Sinkiang, although completely dominating Sinkiang's trade relations with the outside world.

LIGHT TRAINS FOR JAPAN.—Spurred by the successes in the United States, France and Germany of stream lined, aluminium-alloy trains, the Japanese Ministry of Railways announces plans for construction of similar conveyances. The trains will be driven by Diesel-electric power, that will give them a maximum speed of about 120 kilometers an hour, a high figure for Japan's narrow-gauge tracks. They will cost Y.90,000 each and consist of three connecting coaches.

CANTON-HANKOW RAILWAY.—With reference to the application of the Nanking Ministry of Railways for a loan of £100,000 for repairs to the road-bed of the Hupeh-Hunan section of the Canton-Hankow Railway, it is learnt that the Trustees of the British Boxer Indemnity Refund requests that a detailed specification of the proposed work be submitted. Up to date the Ministry of Railways has obtained loans from the British Boxer Indemnity Refund aggregating £210,000.

KIANGSI-FUKIEN RAILWAY.—Measures for the construction of the Kiangsi-Fukien Railway have been agreed upon. The projected line will be approximately 100 miles in length, extending from the Shangjao station of the Chekiang-Kiangsi Railway southwards to Foochow, via Yenping, in northern Fukien. A loan of $18,000,000 is to be obtained from a Shanghai financial group, $10,000,000 to be employed in the construction of stations and the road-bed, while $8,000,000 will be used for the purchase of rails and rolling stock.

MANCHOUKUO RAILWAY BUILDING LIMITED.—A decision to halve expenses for railway construction to Y.60,000,000 in the next fiscal year has been made by the Manchoukuo Railway Construction Bureau. Only two new lines will be built next year, although work will be continued on railroads already under construction. All railways to be built in the first part of the road-construction program will be completed by 1938. After that year, new lines will be laid at the rate of 300 kilometers a year, at a cost of more than Y.35,000,000.

COMMUNICATIONS

NEW STEEL BRIDGE.—A modern steel bridge is under construction, to take the place of the Old Bridge of Boats at Ningpo. The city is connected by the New Bridge of Boats which crosses the Yuyao River to the settlement on the west, and with the east suburb by the Old Bridge of Boats, which crosses the Fenhwa branch of the river. It is the Old Bridge which is now to be replaced, and the work is in the hands of a foreign firm.

NEW TOKYO SUBWAY.—Official permission for construction of a subway line between Shibuya and Shimbashi has been issued by the Home Ministry to the Tokyo Rapid Railway Co. The builders' plan to speed the work so that service may be opened by October, 1936. Immediately thereafter the company plans to construct a second line linking the Shinjuku and Tokyo railway stations. The Shimbasni-Shibuya line will be 3.66 miles long. The Tokyo Rapid Railway Co. is a newly-organized concern capitalized at Y.30,000,000.

WIRELESS 'PHONES.—Plans for a domestic wireless telephone service as well as one with foreign countries are in hand in China. Part of the machinery and equipment ordered from England, totalling over eighty cases, recently arrived in Shanghai and was transported to Chenju for installation at the International Radio Station. The rest of the consignment was due by the end of the year. A service first will be installed to link up the more important cities, such as Shanghai, Nanking, Hankow, Tientsin and Peking, and it will be extended to other countries.

CHINESE HIGHWAYS.—Officials are making a survey of the new highway to link Tientsin and Tangku, which, it is understood will be completed before January. The road, which follows the railway, is being temporarily surfaced with cinders, but it is proposed to macadamize it later. An extensive network of highways connecting the seven West China provinces of Szechuen, Kweichow, Shensi, Kansu, Yunnan, Hupeh, and Sikong, is to be completed by next April. The center of this network will be Szechuen province, which now has 3,000 kilometers of motor roads.

CANAL SCHEME.—A canal from Fushun to Yingkow is contemplated. According to the Japanese plans this canal will be constructed at an estimated cost of $30,000,000 and is to be completed in five years. It will start at Wushun, connect with the Hun River, pass through Mukden, join the Liao River and terminates at Yingkow. Of the total estimated expenses it is stated that $2,500,000 will be used in excavation work, $3,000,000 in building the wharf at Yingkow, while the remainder will be expended on constructing water reservoirs, dikes and ships. The reservoirs will be utilized to generate electricity, which will be employed to exploit and irrigate the farm lands along the banks of the canal.

NEW HIGHWAY.—A loan of $1,500,000 obtained by the Hunan Provincial Government will be used for the construction of a highway linking up the provinces of Hunan and Szechuen.

NEW LUAN RIVER BRIDGE—All preparatory engineering work having been completed, construction work was to begin on December 1, on the new iron bridge spanning the Luan River. The bridge, when completed, will be 2,500 feet long and will cost $2,000,000. The Peiping-Liaoning Railway Administration is building the new bridge.

CABLE CAR TO MOUNT FUJI.—The time required for pilgrims to climb Mount Fuji will be reduced from a day to about forty minutes if plans for the construction of an underground cable car line up Japan's sacred mountain are carried out. Application for the construction of a tunnel incline up the slope from Yoshidaguchi at the base of the mountain has been filed. The cost is estimated at Y.5,000,000.

MINING

SULPHUR IN PUTIEN.—Extensive sulphur deposits have been discovered in Putien, south-eastern Fukien. The Provincial Department of Reconstruction has dispatched Mr. Li Chi-shan, technical expert, to investigate.

KOREAN ALUMINIUM.—Chosen Nitrogen Fertilizer Co. plans to manufacture aluminium out of alum stones, according to the *Nikkan Kogyo Shimbun*. The idea was announced at a meeting of businessmen held under the auspices of the Korean Chamber of Commerce and Industry.

IRON MINE MERGER.—Japan Iron Manufacturing Company has decided to negotiate for purchase of the Mozan Iron Mine in Korea, but ere the contract is concluded a thorough survey of the ore deposit will be made. They are said to be somewhere between 60,000,000 and 200,000,000 tons.

MINING CONCESSION.—The Sumitomo Goshi Kaisha, most powerful of Osaka business houses, is reported to have acquired a South China mining concession at an expenditure of Y.15,000,000. It is in the province of Kwangsi, and gold, iron, manganese, tungsten and other products are said to be available.

LUNGYEN IRON ORE.—Experts of the South Manchuria Railway are said to be very favorably impressed by the deposits of iron ore near Hsuanhua, about twenty miles south-east of Kalgan, known as the Lungyen ore field. The railway company is sending metallurgical experts to the site, and is contemplating a Sino-Japanese company with a capital of 50,000,000 yuan for exploitation purposes.

OIL IN SHENSI.—Plans for developing the petroleum resources in Shensi Province have been drawn up by the Nanking Ministry of Industry. It is estimated that the project will require a total of $10,000,000, of which $7,000,000 will be invested by the Government. It is understood the project will be carried out through a semi-official corporation under the joint auspices of the Government and Chinese industrialists.

BOXER FUNDS.—At a meeting of the Trustees for administration of the British Boxer Indemnity Refund, on January 13, the application of the Kwangtung Provincial Government for a loan for the exploitation of a coal mine at Yungkong, was granted. Conditions were that an investigation be conducted regarding the quality and quantity of the coal deposits and the security to be offered for the loan; the proposal for the construction of a branch railway to the mines to be approved by the Ministry of Railways; funds be first raised by the Kwangtung Provincial Government for the construction of the branch railway and for the initial administration thereof.

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